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Vol. III.

DEVOTED TO THE ECONOMY AND LIFE-HABITS OF INSECTS,
ESPECIALLY IN THEIR RELATIONS TO AGRICULTURE.

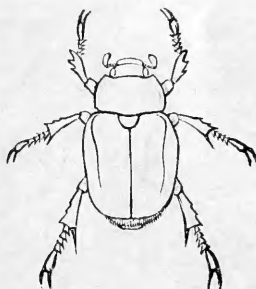
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SPECIAL NOTES.

Index to Vol. II—Date of Publication.—We send out with this number the index and table of contents to Volume II. Their preparation was delayed beyond the publication of the final numbers of the last volume by press of other work. In view of the difficulty experienced during the past year in promptly issuing a monthly number, owing to circumstances beyond control and connected with the very nature of Government work, we shall revert to the plan originally announced in Vol. I, No. 1, of issuing twelve numbers to a volume, with no attempt to publish one for each month, as we have endeavored to in the past.

Bulletin 22, Division of Entomology.—Bulletin 22 of the Division of Entomology has just been issued from the press. It is entitled "Reports of Observations and Experiments in the Practical Work of the Division," and comprises articles by Messrs. Coquillett, Webster, Osborn, Koebele, Bruner, and Miss Murtfeldt, being in the main their reports of observations for the season 1889, omitted from the Annual Report for want of space.

Mr. Coquillett reports upon the destruction of the Red Scale of California (*Aonidia aurantii*) by the use of washes.

Professor Osborn reports principally upon the leaf-hoppers injuring forage plants, and Professor Webster upon grain insects and certain points connected with the economy of a few well-known pests to other crops.

Miss Murtfeldt sends in a general report on the insects of Missouri for the season. Mr. Koebele reports upon some injurious California insects, and particularly upon the Pacific Slope parasites of the Codling Moth. Professor Bruner treats of insects of the year and begins the consideration of the insects detrimental to the growth of young trees on tree claims in Nebraska and other portions of the West, an important subject which has not before received treatment.

Mr. Bruner on Insects injurious to young Trees on Tree Claims.*—We have just referred to the report by Mr. Bruner upon this subject in Bulletin No. 22 of this Division, and now call attention to his more elaborate paper, which covers 150 pages of the Nebraska Station Bulletin. The accounts of the species are in the main compiled, but a few original notes are added; 98 figures are introduced, most of which have been published before. The drawing together of these accounts is very appropriate to the subject in hand, and the bulletin makes a handy book of reference for the tree-grower in the arid regions of the west. The appendix includes a consideration of remedies.

Catalogue of the Spiders of temperate North America.†—When the study of any branch of zoölogy has progressed sufficiently to permit so extensive and careful a list as that prepared by Dr. Marx of the spiders of America north of Mexico, our knowledge thereof may be said to be placed upon a basis from which progress is comparatively easy. The extent of the catalogue surprises us, including, as it does, about a thousand species. It is more than a catalogue, as all of the synonyms of families, genera, and species have been worked out by Dr. Marx, and are published with full bibliographic references. An index to families and genera, to synonyms of genera and a separate bibliography as well as a series of notes add greatly to the working value of the catalogue. We anticipate that the publication of this work will greatly increase the number of students of spiders and regret only that it was not prefaced with a few practical hints as to collecting and preserving.

Vesicatory Insects.—We have just received from the author, Prof. H. Beauregard, his monograph of the vesicatory insects.‡ For ten years Professor Beauregard has been at work upon this subject and has given us a monograph which exhibits the greatest ability and industry. He has taken up in succession the following phases of his subject: Part I, concerns the anatomy of these insects; Part II, the physiology and pharmacology. In this second part he especially treats of the place which the Cantharides hold among insects and of the comparative vesicating power of a large number of species of many genera. Part III is devoted to the habits of the different forms and to the study of their

* Bulletin Agricultural Experiment Station of Nebraska, Vol. III, Article 2: Insects injurious to young trees on tree claims; by Lawrence Bruner, Entomologist, Lincoln, Nebr., June 7, 1890.

† Catalogue of described Araneæ of Temperate North America, by Dr. George Marx. Proceedings U. S. National Museum, Vol. XII, pages 497 to 594. Extra No. 782. Washington: Government Printing Office, 1890.

‡ Les Insectes vésicantes, Par H. Beauregard, Paris, Baillière et Cie. 1890.

life-history, including their extremely interesting larval development. Part IV comprises a historical chapter and a general consideration of the genera, followed by a catalogue of species and a full bibliography.

The work extends over more than 500 pages of Royal octavo print, and in addition to many text figures there are nineteen lithographic plates, many of them double size. The greatest feature of the work, and the one upon which Professor Beauregard is to be most congratulated, is the fullness with which many of the larval histories have been worked out. He has admirably summarized the observations of others and has greatly added to our knowledge of the transformations of these interesting hyper-metamorphic creatures. He has given us *de novo* the full history of *Epicauta verticalis*, which is entirely parallel with that of our American congeneric species, and also of *Cerocoma schreberi*, and he has independently followed out and added many new points in the histories of *Sitaris humeralis*, *Stenoria apicalis*, *Cantharis vesicatoria*, and *Zonitis mutica*. In this connection Professor Beauregard has attempted a classification of the Blister-beetles based on the larval transformations and habits, which, although corresponding, to a certain extent, with the classification derived from the characters of the adults, yet differs in important particulars. It is in the same direction as Brauer's proposed classification of the Diptera from their larvæ and the attempts of various older authors, such as Dr. Horsfield, to compass the same result with Lepidoptera. Beauregard gives us, however, careful and extended descriptions of the larval forms of three species of *Melœ*, two species of *Sitaris*, one of *Cantharis*, two of *Zonitis*, two of *Epicauta*, two of *Cerocoma*, and five of *Mylabris*.

Obituary Notes.—Never before in its history has Entomology suffered so many losses by death within such a short time as during the past few months. Such well-known workers as Fr. Loew, Keyserling, Letzner have been taken from us, and now we have to record a number of other deaths:

Dr. Adam Handlirsch, of Vienna, died on March 24, aged twenty-seven years. He has written a number of Dipterological papers, among them interesting observations on the life-history of the genus *Hirmon-
eura*.

Mr. J. S. Baly's death was announced by Mr. Godman at the April meeting of the London Entomological Society. His specialty was the study of *Chrysomelidæ* from all parts of the world, and he published numerous descriptive papers on this family. His best-known papers are the Descriptive Catalogue of the genera and species of *Hispidæ* and the *Phytophaga Malayana*.

We are also informed of the death of Abbé S. A. de Marseul, the founder and editor of the journal "Abeille" and more widely known as the author of a masterly monograph of the *Histeridæ*.

Finally a few days ago we received the sad news that Dr. Hermann Dewitz, Custos at the Zoological Museum of Berlin, Germany, died on May 16, after long illness, at the age of forty-two years. He was a personal friend and correspondent and published a number of smaller papers on a great variety of entomological subjects, notably a series of articles on the motion of insects on smooth vertical surfaces. In descriptive entomology he was interested in West and Central African butterflies and also wrote a descriptive paper on the earlier stages of exotic Lepidoptera.

The death of Dr. George Thurber, one of the first horticultural writers of America, is a sad blow to his many friends and admirers, and a deep personal loss to the Entomologist, who had a delightful personal acquaintance with him for many years. Dr. Thurber was born in Providence, R. I., in 1821, and was a naturalist of the United States and Mexican Boundary Survey in 1850, on which expeditions he collected the immense stock of plants which furnished the material for Asa Gray's 'Plantæ Novæ Thurberianæ,' published in 1854. He later lectured on chemistry and botany at the Cooper Union and before the New York College of Pharmacy, and in 1859 was chosen to the chair of Botany and Horticulture in the Agricultural College of Michigan, which place he filled until he became editor of the *American Agriculturist* in 1863. After twenty-two years of singular success as editor of this journal, he was compelled from failing health to relinquish its active control, though he continued to contribute to its columns till within a short time of his death. He published several books relating to agriculture and country life, "American Weeds and Useful Plants," which appeared in 1859, being still the standard work on the subject, and he also wrote the botanical articles in Appleton's Cyclopaedia. His knowledge of insects was perhaps greater than that of most persons who make no profession of it, and his correspondence with the writer is full of keen observation and suggestion, with an unrivaled admixture of humor.

Mr. Weed on Ohio Insects.—In the entomological portion of the bulletin of the Ohio Agricultural Experiment Station, second series, Vol. III, No. 4, Mr. Clarence M. Weed presents a number of practical articles on Economic Entomology, comprising the following subjects: Spraying to prevent insect injury, Bark-lice of the Apple and Pear, the Buffalo Tree-hopper; insects affecting corn, and the Ox-Warble-fly or Bot-fly.

In the first article a number of available spraying devices are described and figured. The more important insecticides are also given and the methods of applying each to various crops are described. The Bark-lice of the Apple and Pear treated are the well-known pests, the Oyster-shell Bark louse (*Mytilaspis pomorum*) and the Scurfy Bark-louse (*Chionaspis furfurus*). In the discussion of the injury occasioned to fruit

trees by the egg-punctures of the Buffalo Tree-hopper (*Ceresa bubalus*) he suggests as a remedy the spraying of the infested trees with kerosene emulsion during May, or as soon as the eggs hatch, to destroy the young before they have scattered to other vegetation.

The corn insects noted are the White Grub, the larvæ of the common Twelve-spotted Cucumber Beetle (*Diabrotica 12-punctata*), and the Corn Root-louse. Rotation is advised as a means against the first; for the second the theoretical course is proposed of planting squashes, etc., in the fields to lure the beetles and induce them to deposit their eggs about the vines rather than the corn. By destroying the vines the young larvæ would die of starvation.

In the case of the Root-louse no effective remedy has been discovered. The articles on the Ox-Warble-fly or Bot-fly consist of a review of the publications on this subject in the *Farmers' Review*, *INSECT LIFE*, and of pamphlets by Miss E. A. Ormerod. Abstracts from the two latter sources are given. All the articles mentioned are well illustrated and some of the figures are new.

A PEACH PEST IN BERMUDA.

(*Ceratitis capitata* Wied.)

Order DIPTERA: Family TRYPETIDÆ.

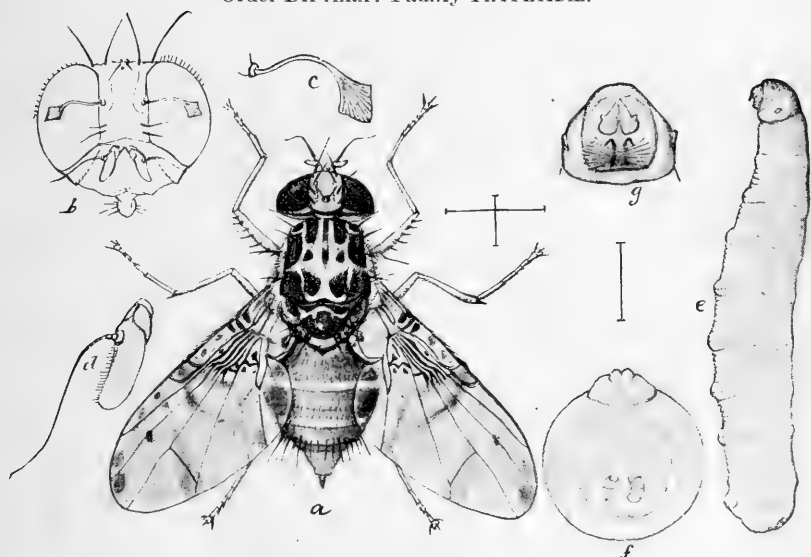


FIG. 1—*Ceratitis capitata*: a, female fly; b, front view of head of male; c, spatula-like hair of male shown at b; d, antenna; e, larva; f, anal extremity of same; g, head of same—all enlarged (original).

This peculiar and strikingly beautiful Trypetid fly was described by Wiedemann,* in 1826, as *Trypeta capitata*, and by him recorded from East India. It was subsequently redescribed by Macleay, in 1829,† as

* *Analecta Entomologica*, p. 54, No. 124.

† *Zoölogical Journal*, Vol. IV, pp. 475-482.

Ceratitis citriperda, who stated that it was destructive to oranges in Madeira.

In the *Gardeners' Chronicle* for 1848 (page 604) Westwood published a beautiful figure of the species, with indefinite sketches of larva and puparium, and gave quite a lengthy account of the insect from specimens received from St Michael's (Azores). A number of short notes have been published by Guérin, Macquart, and Heineken in the older publications, and it was recorded by these authors from the Azores, Madeira, Cape Verde Islands, Mauritius, and, by hearsay, from the West Indies. Westwood also mentions two other species, one from the gold coast of Africa and the other from Andalusia.

Very recently Rev. H. Henslow (*Gardeners' Chronicle*, May 24, 1890, Vol. VII, p. 655), gave an account of the same insect, which has become very troublesome in Malta, where it appeared about fifteen years ago and has increased to a very injurious extent during the last three years. A committee was appointed in 1889 by the late governor of Malta, charged with the preparation of a report which will be published shortly in the Kew Bulletin. The fly penetrates the half-ripe orange and lays several eggs within it. This causes the fruit to fall when the larva escapes and enters the ground to transform. The remedial measures suggested are to collect and destroy the fallen fruit and to strew the surface of the ground under the trees with a mixture of one part of finely-powdered sulphate of iron to twenty-four parts of sand, the ground to be subsequently watered. The pest is said to particularly attack the Mandarin in Malta, and to be more abundant in a hot dry season than in cold or inclement weather. Thus there appears no record of damage by this pest to any other crop than the Orange.

Osten Sacken, in the *Entomologist's Monthly Magazine* (XXI, p. 34, July, 1884), makes the general statement that this fly is injurious to citrus fruits wherever grown. This, however, seems to be a mistake, for the very large orange and lemon industries in this country seem never to have suffered from this insect, nor indeed from any allied species, although, as we have shown (*INSECT LIFE*, Vol. I, p. 45), *Trypeta ludens*, a species of the same family, injures oranges in somewhat the same way in Mexico.

Last April, however, we received from Mr. Claud W. McCallan, of St. George's, Bermuda, an injured peach infested by maggots. Mr. McCallan in his accompanying letter stated that this pest completely destroys the peach crop in the vicinity of St. George's, and that Dr. T. A. Outerbridge "some years ago took a peach or two and placed them in a bottle with a

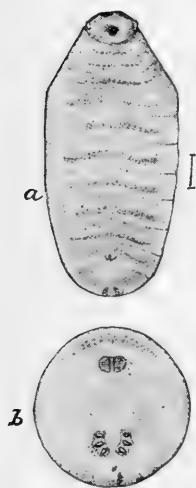


FIG. 2.—*Ceratitiscapitata*: a, pupa; b, anal extremity of same—enlarged (original).

wide mouth over which he put a gauze and as the peach decayed the maggots grew and soon hatched out flies."

Later letters from Mr. McCallan accompanied further specimens of diseased peaches and conveyed the information that the crop has been infested in the Bermudas for about twenty-five years; that many persons have cut down their trees which are now becoming very scarce. Prior to this, however, they were most abundant and could be looked upon as almost growing wild. The peach is the first tree to blossom in that locality, beginning about the last week in January. Soon after the fruit appears and when about one-third grown it is punctured by the fly. It continues to grow, however, but instead of ripening it suddenly becomes quite soft and decayed and drops from the tree upon the ground, full of maggots and perfectly useless.

Examination of the maggots found in the fruit first sent by Mr. McCallan showed that they were nearly full grown and resembled that figured at Fig. 1, *e*. The larva is white or pale yellowish, the mandibles black, the anal respiratory tubes projected, trilobed and pale brown at tip. They were placed in a jar and soon left the fruit, entering the ground and transforming to pale yellow puparia from one-fourth to one inch below the surface of the ground. The first peaches were received April 23, 1890, and on May 9 sixteen adult flies issued, and upon careful comparison with figures and descriptions of *Ceratitis capitata* they proved to be identical.

The figure well represents the appearance of the fly and no technical description is necessary. The general color is yellow in both sexes and the markings vary from dusky to black. Strikingly characteristic are the two peculiar spatula-like hairs upon the head of the male, shown at Fig. 1, *b, c*.

As we wrote to Mr. McCallan under date of May 13, soon after breeding the first adults, the best remedy which can be suggested at this time will consist in feeding or otherwise destroying the fruit immediately after it falls to the ground. This should be done before they have time to leave the fruit and crawl off under sticks and stones or under the surface of the ground to pupate. The matter is somewhat complicated, however, for the reason that the insect is so far known in the Bermudas only in the spring months, and, as our breeding has indicated, the flies appear in May, and we know nothing further of them until they oviposit the following February or March.

With our knowledge of the habits of the insect, derived from writings of those who have mentioned it as an orange pest, it seems altogether likely that there is more than one generation and that the flies issuing from peaches in May oviposit in some other fruit, and in this event the destruction of the peaches will only prove a partial remedy, unless it should turn out that a generation in the peach at this time is necessary

to fill a gap in point of time in the life of the insect. These are matters which we hope to decide by future correspondence and investigation.

None of the previous writers give us an inkling as to the number of broods, but judging from the rapid development above indicated there should be six or eight generations in the course of a season provided food is at hand. It is altogether likely that the arsenical remedies will be of no effect on account of the fact that the eggs are probably inserted beneath the skin of the fruit and not fastened to it.

The subject derives an especial interest from the danger of the importation of this pest into the peach-growing regions of our Southern States. It is beyond doubt a tropical insect, and there is consequently reason to believe that it will not thrive in the Northern States, but peaches are grown extensively in Georgia and allied fruits in Florida, and although peaches are not received from Bermuda in bulk the accidental importation of the pest is always possible.

NOTES UPON THE CANKER WORM.

By Prof. C. W. HARGITT, *Oxford, Ind.*

I learned during the past winter that a large orchard (apple) in the vicinity of Oxford, Butler County, Ohio, was subject to very serious ravages from some caterpillar, which from the general description from one not accustomed to close observation, I suspected might be *Clisiocampa sylvatica*. Having no means at hand of determining the matter definitely, I asked to be notified at once if they made their appearance the following spring. On June 5, I had notice that the depredations were under way and at the earliest available moment I secured conveyance, and on the 9th drove to the orchard, some 4 miles distant. When nearly a mile from the place a very strange sight appeared. The orchard looked as if it had been burned and scorched by fire, except a small corner extending some distance diagonally from the main orchard, and the outer rows of trees. These, except upon a side adjoining a wood, were comparatively free from injury. Upon entering the orchard a sad sight was presented. Many trees were dead, the result of previous attacks. Others were evidently dying, and the entire orchard, with the exception above mentioned, was very greatly damaged. We were doomed to disappointment so far as being able to find the various stages of the devastating work. The worms had, in the language of the owner, "run their course;" and it was with difficulty that enough specimens could be found for identification.

From the owner, Mr. C. C. McCreary, I was able to gather the following points: (1) The depredations had been going on during a series of about five years, and growing worse each year. (2) They appeared

first in the interior of the orchard, but on the side nearest the wood. (3) They were allowed to continue under the impression that they would probably "run their course" in a season or two and then disappear. (4) Several sorts of birds had been noticed to specially frequent the orchard during the period of the ravages, especially the common cedar birds, the bluebird, chipping sparrow, and others. I noticed during our stay in the orchard the following birds which appeared to be engaged in searching among the withered leaves for the remaining worms: The cedar bird, bluebird, chipping sparrow, song sparrow, summer warblers, robin, cat-bird, crested fly-catcher, kingbird, and a few others passing through, but not apparently engaged in seeking food.

Mr. McCreary informed me that during the earlier part of the spring when the worms were abundant the birds were more numerous.

Altogether the case seems similar in many respects to the report made by Dr. S. A. Forbes in Bulletin No. 6, of Illinois State Laboratory of Natural History.

There remains another interesting point to be considered, of which I have seen no account, in reference to the Canker-worm, namely, some indications of parasitism among the worms this year. Upon going into the orchard Mr. McCreary expressed surprise at not finding more worms, stating that only a few days previous they were fairly plentiful, though much less abundant than a fortnight earlier. This suggestion, together with the sickly appearance of two or three specimens noticed, led me to suspect the possible influence of parasitism. Further search revealed the presence of dead worms, though not in any considerable numbers, of the evident appearance of parasitized specimens. Whether this had been extensive appears doubtful, though the obvious indications of it are interesting. I regret that I had not information in sufficient season to more satisfactorily study the case in detail. It should be stated that Mr. McCreary undertook on a small scale the experiment of spraying a few trees with London purple, but owing to the almost incessantly rainy weather prevailing at the time it was practically of no consequence.

JUNE 10, 1890.

MONOSTEGIA IGNOTA Norton.

By FREDERICK W. MALLY.

Since the appearance of my article in *INSECT LIFE*, Vol. II, No. 5, pp. 137-140, on the life history of *Monostegia ignota*, additional points of interest in its development have been ascertained. This, together with a desire to consider Mr. W. H. Harrington's article in *INSECT LIFE*, Vol. II, Nos. 7 and 8, pp. 227-230, induces me to collect my notes in the form of a short article.

At the time my former article was written it was too early to assert positively that this species was single brooded. This point is now positively determined, as the larvæ obtained from eggs deposited by the imagos in confinement have been kept in the usual way in a breeding cage until now, when the imagos have emerged. Thus I have the history of this species from imago to imago again, and have the original females for comparison.

Mr. Harrington's difficulty seems to be a kind of reluctance to recognize two distinct species of saw-flies attacking the strawberry and a suspicion that it is only one species with variations. If all the imagos collected by him are *Harpiphorus maculatus* Nor. it is evident that the venation, size, and coloration of that species are very variable. It is the evidence pointing to the establishing or separation of the strawberry saw-flies into two species that I wish to consider briefly.

Dr. C. V. Riley, who has so thoroughly traced the life history of *H. maculatus*, gives a description of the larvæ from which the imagos were reared, in the *American Entomologist* Vol. I, p. 90. From this description we find that the larvæ of *H. maculatus* may be distinguished from those of *M. ignota* by having three large black spots on the head. Thus the question to be determined is whether these characters of the larvæ are constant, and whether the imagos reared from them are constant. This I hope to do by presenting proofs for the same or referring to the literature on the subject in such a way that those interested may investigate and decide for themselves.

Through the kindness of Prof. F. M. Webster, of Lafayette, Ind., I have before me the larvæ from which he reared imagos of *H. maculatus*. These larvæ bear the three black spots on the head, as described by Riley. Through the kindness of Prof. S. A. Forbes I have before me the imagos of *H. maculatus*, and also a part of the lot of larvæ from which they were reared. Again, it is found that the larvæ bear the characteristic markings of the head already spoken of. Thus, from the writings of those who have traced the life history of *H. maculatus* from imago to imago, again it appears that the above-noted larval characters are constant, and that the imagos reared from them are also constant.

My own experience in rearing imagos from larvæ with heads of a uniform yellowish brown color has already been stated in a former article. However, a few observations made by Professor Osborn and my brother, Charles W., at Ames, Iowa, this spring, may be of interest as a check on my work of last year. The breeding cage containing the saw-fly larvæ which were reared from eggs deposited in confinement was left in charge of Professor Osborn when I left for Champaign last October. This spring Professor Osborn sent me imagos of both sexes taken from this cage, and stated that they had emerged April 16, 1890. About the same time my brother made sweepings on the same strawberry bed where I had collected last season, and he also sent me a number of specimens.

From the labels on the specimens I note that the earliest date of capture is April 18, 1890, and the latest April 28, 1890. He informs me by letter that after this date no imagos were captured, though he made several sweepings of the strawberry bed on later dates. This agrees in the main with my own observations as to the date of appearance, period of egg-deposition, etc.

Comparing the reared specimens of *M. ignota* sent me by Professor Osborn with those I studied last year and those collected by my brother this spring, I find them all to be identical. The venation of the wings of the twenty-two specimens of *M. ignota* collected this spring, and which are now before me, could not be more constant, even in minute details. The imagos vary slightly in size, and considerably in the distinctness of the spots on the back of the abdomen.

I have before me specimens of both sexes of *H. maculatus* and *M. ignota*. As I look at them I note the following differences: First, *ignota* is larger and more robust. Second, the general color of *ignota* is a shining black, which is equally true of the head and thorax of *maculatus*, but the color of the abdomen of the latter is distinctly brown. Third, the spots on the back of the abdomen of *maculatus* are more distinct and striking, due to their pure white color, than *ignota*, in which the spots vary from a light gray to black, in which latter case the abdomen is of a uniform black color. Fourth, the legs of *maculatus* have much more white than those of *ignota*. The above-named differences are such as can be readily noted by comparison. Except venation of the wings I must say that, so far as I have observed, the color and markings of *H. maculatus* are quite distinct and constant.

Reviewing the points brought out by this brief discussion of the life histories of the larvæ and imagos in question, we find that the larvæ may be separated into two distinct kinds by strong and well marked characters; that the imagos reared from each kind of larvæ are also distinct and constant and can be easily separated by comparison. The only conclusion which I can arrive at from the above given evidence in addition to the details of what has been given at previous times by other authors, is that there are two species of saw-flies attacking the strawberry. My conclusion at the first was not hastily made, nor was it based solely on the difference in venation of the two species, but rather upon the only true basis, that of a study of the characters and habits of the various stages of their metamorphosis.

My statement in a former article that the two species could be readily distinguished by noting the difference in venation was made before anything had been written concerning the variability of the venation of *H. maculatus*, and was correct so far as our knowledge of that species went at that time. Since the publication of Mr. Harrington's article I have brought together as many specimens of *H. maculatus* as possible, so that I might study the venation of that species. I can verify Mr. Harrington's claim as to the variability of the same. Twenty-six specimens

were carefully studied with the following result: Those having the normal venation, males 3, females 19; those having three submarginal cells in one anterior wing and four in the other, males 1, females 3. No specimens were found having four submarginal cells in both anterior wings, as were found by Mr. Harrington. It has been my experience that where variation in venation occurs at all it is not the same in both wings. As already stated, not the least variation in venation was found in the specimens of *ignota* studied, which with this season's material runs up to some fifty specimens.

In my study of Iowa and Illinois saw-flies I have found considerable variation and uncertainty in their venation, and do not consider it a safe basis (other things being equal) for distinguishing species. Of the species which have been found to be especially variable in this respect are *Nematus ribesii* Scop., *Monophadnus rubi* Harris, *Eriocampa cerasi* Peck, and in a less degree *Pristiphora grossulariæ* Walsh.

DESCRIPTION OF THE MALE OF MONOSTEGIA IGNOTA Nor.

Since the male of *M. ignota* to my knowledge has not been described I append a description of the same herewith:

Male.—Body shining black, less robust than the female. Antennæ about as long as the head and thorax, finely hairy, slightly enlarged in the middle; first joint twice as long as the second, third longer than the fourth, remaining joints subequal. Head black, rugose, slightly hairy, with three depressions about the ocelli and one extending around the base of each antennæ to the base of the clypeus. Nasus crenate. Anterior angles of the prothorax white or dusky, spots on the tergum light gray or fuscous or entirely wanting. Legs black. Knee joints of all the legs whitish or fuscous, anterior and middle tibiae with their tarsi light brown or fuscous. Wings and venation same as in the female.

One specimen has the knee-joints of the posterior pair of legs black, another has the legs of a uniform color throughout.

LARVÆ OF A CRANE-FLY DESTROYING YOUNG WHEAT IN INDIANA.

By F. M. WEBSTER, *La Fayette, Ind.*

Although the larvæ of these flies have long been known to be destructive in England, reports of their ravages in America have been very rare, and besides of quite recent occurrence. An outbreak appears to have occurred in meadows in southern Illinois in 1887,¹ and we studied another in clover fields in Madison County, Indiana, in the spring of 1888, while a report of injury to growing wheat in California, in March, 1889,² closes the list, unless we include complaints of injury to wheat about Champaign, Illinois, in 1885,³ which, though at the time

¹ *Prairie Farmer*, July 16, 1887.

² *Pacific Rural Press*, March 23, 1889.

³ *Prairie Farmer*, September 18, 1886.

attributed to earth-worms, might possibly have been due to Tipulid larvæ.

April 24, of the present year, Mr. J. G. Kingsbury, of the *Indiana Farmer*, called my attention to reports from Mr. T. H. Kendall, in reference to the ravages of an unknown worm which had been observed some time previous in the wheat fields in the vicinity of Farmersburg, in the extreme northern part of Sullivan County.

A visit to the locality on the 26th, and especially to the fields of Mr. Kendall, revealed the nature of the depredator and effect of its ravages. The insect was, at the time, the most abundant in the pupal stage, these pupæ, after the manner of the *Tipulidæ*, in general occupying vertical cells in the ground. Larvæ were, however, present in considerable numbers, both in the earth and on the surface, and not only about the wheat plants, but also about stray clumps of timothy, of which there were a considerable number scattered over the field among the wheat. For reasons which will appear further on, the numbers present in both stages did not correspond at all with the reports of Mr. Kendall nor with the amount of damage clearly attributable to the pest. The most seriously injured fields were those which had been in clover the previous year.

Of two fields, adjoining each other, one sown on oats stubble, the other on clover sod plowed early in October, the latter was damaged fully fifty per cent. while the former had escaped uninjured. Another field, a short distance from these, also in clover last year but plowed late in August, was damaged only about fifteen per cent. A clover field, adjoining the first two, had been completely ruined, but this might have been in part due to the winter, although the insect was present in abundance. A close inspection of the most seriously injured fields showed large areas of grain totally destroyed, while other areas among them were little injured.

The plants themselves have not been thrown out by the frost, but were well fixed in the soil. The day was rainy, and many of the dead plants had a green appearance like that of wetted hay, and did not at all resemble those killed by frost or freezing, indicating that they had withered.

Mr. Kendall stated that up to the first of February his wheat was in fine condition, but after that time it began to die, and continued to do so rapidly until about the first week in April, since which time the depredations had gradually ceased. Soon after the trouble began he had observed the larvæ in myriads, both above and below ground, but they worked below, not cutting off the plants, but apparently wounding them and sucking the juices.

In working about just beneath the surface of the ground they raised ridges like those made by the mole but about the size of straws, and the earth immediately about the plants was often worked up as if by ants or earth-worms.

A large number of larvæ and pupæ were secured and taken home in order that I might be able to study the method of feeding in the larvæ, secure adults, and watch the oviposition of the females which, I judged, might differ from those previously studied in case they proved of a different species. While collecting this material, not only many dead pupæ were noticed, but also larvæ, lying on the surface of the ground, many of which had turned black, wholly or in part after the manner of diseased Cabbage-worms, which led to the suspicion that they had been attacked by a fungus disease, which had reduced their number and consequent injury. While all living material was, on my arrival home, placed in a breeding cage and thus kept out of doors, all of the pupæ were destroyed, almost entirely, I believe, by this fungoid enemy, which Dr. J. C. Arthur informs me is undescribed, and for which he proposes the MS. name *Empusa pachyrrhinæ*. One larva constructed its cell, in the earth in the breeding cage, and transformed to the pupa, but the next day this pupa worked itself upwards out of the cell, and was found lying on the surface dead and covered with spores of *Empusa*. How much this fungus had to do with the stopping of depredations of the larva on the wheat, it is of course impossible to say, but it must have destroyed a large portion of the pest.

The first adult appeared in the cage on the 28th, two days after removal from the field, and proved to belong to the genus *Pachyrrhina*. The adults emerged so very sparingly, and at such long intervals, that no opportunity was offered to secure fertilized eggs or note the ovipositing habits of the females. The first of the only two females reared was nearly dead when a male emerged, and, though fertilized, died without ovipositing, and the male refused to pair a second time, leaving the second female without a mate, she dying before a second male emerged. Two females and four males were all the adults secured from the material brought home. An occasional adult was observed in the vicinity of La Fayette and one found in a breeding cage placed over a plat of blue-grass, which fact, together with the occurrence of the larvæ about timothy, in Mr. Kendall's field, leads to the suspicion that the insect may breed in both grasses and clover. Young wheat was seriously damaged during March throughout the State, but how much was due to the attacks of these insects it was impossible to determine.

MAY 24, 1890.

SOME OF THE BRED PARASITIC HYMENOPTERA IN THE NATIONAL COLLECTION.

(Continued from p. 353 of Vol. ii.)

Family **BRACONIDÆ**—Continued.

Subfamily **Microgasterinæ**.

Parasites.

Hosts.

Mirax aspidiscæ Ashm	<i>Aspidisca splendoriferella</i> Clem., on Apple. Washington, D. C., July 25-28, 1879.
Mirax lithocolletidis Ashm	Leaf-miner on locust. St. Louis, Mo.
Mirax grapholithæ Ashm	<i>Grapholitha prunivora</i> Walsh, on Apple. Washington, D. C., May 3, 1881.
Apanteles carpatus Say	<i>Tinea pellionella</i> . Adrian, Mich., June 17, 1885.
Apanteles edwardsii Riley	<i>Tinea tapetzella</i> . St. Louis, Mo., July.
Apanteles cacæciæ Riley	<i>Pyrameis atalanta</i> L. New York.
Apanteles cacæciæ Riley	<i>Cacæcia semiferana</i> Walk., on Box Elder. St. Louis, Mo., June 21-29, 1876.
Apanteles megathymi Riley	<i>Megathymus yuccæ</i> Bd. Lec., on Yucca, Bluff- ton, S. C., Apr. 27, 1877.
Apanteles limenitidis Riley	<i>Limenitis disippus</i> Godt., on Poplar. St. Louis, Mo.
Apanteles limenitidis v. flaviconchæ Riley	<i>Colias?</i> on Grass and Clover. St. Louis Mo., May 7, 1873; Oct. 18, 1881; Cadet, Mo., Apr., 1884.
	<i>Leucania unipuncta?</i> Bradford, Conn., June, 1880.
	Found also at Washington, D. C., Aug. 29, 1882, and Sept. 1, 1882, at Cham- paign, Ill.
Apanteles koebelei Riley	<i>Melitta anicia</i> on <i>Castilliana parviflora</i> . Summit Station, Cal., July, 1887.
Apanteles hyphantriæ Riley	<i>Hyphantria textor</i> Harr. Washington, D. C., 1887.
Apanteles lunatus Pack	<i>Papilio asterias</i> F. Athens, Ga., Aug. 1, 1885.
Apanteles argynnidis Riley	<i>Argynnis cybele</i> F. Washington, D. C., and Coalburgh, W. Va.
Apanteles xyliua Say	<i>Arctiid</i> larva. Jacksonville, Fla., Jan., 27- 29, 1880, and Washington, D. C., Dec. 7, 1886.
Apanteles scitulus Riley	<i>Spilosoma virginica</i> F. St. Louis, Mo., Apr., 1870.
Apanteles flavicornis Riley	<i>Thanaos juvenalis</i> E., on White Oak, St. Louis, Mo.
Apanteles emarginatus Riley	<i>Acronycta brumosa</i> Guen., on <i>Alnus incana</i> . Washington, D. C., Oct. 21, 1882.
	<i>Papilio troilus?</i> L. Washington, D. C.
Apanteles theclæ Riley	<i>Thecla</i> sp.? on cotton. Augusta, Ga., Sept. 26, 1878; Selma, Ala., Sept. 6, 1880; and Marion, Ala., July 7, 1880.

<i>Parasites.</i>	<i>Hosts.</i>
<i>Apanteles junoniæ</i> Riley	<i>Junonia cænia</i> on <i>Plantago lanceolata</i> . St. Louis, Mo., Oct. 17, 1874.
<i>Apanteles carduicola</i> Pack	<i>Pyrameis cardui</i> L.
<i>Apanteles smerinthi</i> Riley	<i>Smerinthus ocellatus</i> ?* on Willow. St. Louis, Mo., June 10, 1872.
<i>Apanteles orobenæ</i> Forbes	<i>Mesographe rimosalis</i> . Champaign, Ill.
<i>Apanteles paleacritæ</i> Riley	<i>Paleacrita vernata</i> Pack. Lawrence, Kans., May 20, 1869.
<i>Apanteles atalantæ</i> Pack	<i>Vanessa milberti</i> Godt. Coalburgh, W. Va., July 18, 1886. Received also from Dr. Packard, Salem, Mass. Bred also by Dr. Packard from <i>Vanessa atalanta</i> L.
<i>Apanteles utilis</i> French	<i>Pionea rimosalis</i> Guen. on Cabbage. Lone Star, Miss., Oct. 17, 1879.
<i>Apanteles congregatus</i> Say	<i>Darapsa myron</i> Cr. St. Louis, Mo., 1871, and Pleasant Valley, Iowa, Aug., 1889. <i>Sphinx hylæus</i> Dr.? St. Louis, Mo., 1871. <i>Sphinx 5-maculata</i> Haw. St. Louis, Mo., 1872. <i>Sphinx plebeia</i> F. St. Louis, Mo., Nov. 3, 1877; Washington, D. C., Aug. 4, 1885, and Coalburgh, W. Va. <i>Sphinx catalpæ</i> Boisd. Knoxville, Tenn., Oct., 9-19, 1879. <i>Sphinx carolina</i> L. Sandford, Ky., Sept. 11, 1879; Fredericksburg, Va., Sept. 29, 1872; Washington, D. C., Jan. 22-Apr. 18, 1881. Received it also from Montevallo, Ala., and Williamsport, Tenn.
<i>Apanteles acronymetæ</i> Riley	<i>Acronymeta populi</i> Riley. St. Louis, Mo., 1869, and La Fayette, Ind., Sept. 14, 1889.
<i>Apanteles glomeratus</i> L.	<i>Pieris rapæ</i> L. Adrian, Mich., Jan. 19-24, 1883; Adrian, Mich., Feb. 27-Mar. 15, 1883; Mountainville, N. Y., Jan. 4-23, 1884; Philadelphia, Pa., Apr. 21, 1885; Albany, N. Y., Nov. 6, 1885; East Stonehouse, Plymouth, England, Apr. 21, 1884, and Apr. 12-May 5, 1886; Washington, D. C., Nov. 11, 1884, Apr. 30-May 7, 1885, and Brownfield, Me., Apr 14-16, 1886.
<i>Apanteles pholisoræ</i> Riley	<i>Pholisora catullus</i> Cram. St. Louis, Mo., 1878; Coalburgh, W. Va., and Washington, D. C., Aug. 29, 1888.
<i>Apanteles ornigeris</i> Weed	<i>Ornix geminatella</i> on Apple. Champaign, Ill.
<i>Apanteles sarrothripæ</i> Weed	<i>Sarrothripa rewayana</i> . Washington, D. C., July 26 and 27, 1886, and Champaign, Ill.

* This is probably *Smerinthus geminatus* Say.

Parasites.

Hosts.

<i>Apanteles aletiae</i> Riley	<i>Aletia xyliana</i> Say. Crescent City, Fla., and Selma, Ala.
<i>Apanteles cassianus</i> Riley	<i>Terias nicippe</i> on <i>Cassia marylandica</i> . St. Louis, Mo., Oct. 8, 1874, and Aug. 4, 1875.
<i>Apanteles politus</i> Riley	<i>Scoleocampa liburna</i> Guen. St. Louis, Mo., 1872.
<i>Apanteles militaris</i> Walsh	<i>Leucania unipuncta</i> Haw. St. Louis, Mo., June 28, 1869, and Aug., 1875, and Washington, D. C., Apr. 11, 1882.
<i>Microplitis ceratomiæ</i> Riley	<i>Ceratonia amyntor</i> Hb. St. Louis, Mo., and Champaign, Ill.; St. Louis, Mo., Mar. 6, 1874.
	<i>Smerinthus excrucatus</i> Abb.
<i>Microplitis gortynæ</i> Riley	<i>Achatodes zæ</i> Harr. Iowa.
	<i>Hydræcia immanis</i> Guen. on Hop. Knoxboro, N. Y., Jan. 25, 1875.
<i>Microplitis mamestræ</i> Weed	<i>Mamestra picta</i> Harr. Washington, D. C., Sept. 1884; Albany, N. Y., 1887; Champaign, Ill.
<i>Microgaster gelechiæ</i> Riley	<i>Gelechia gallæsolidaginis</i> Riley. St. Louis, Mo., Apr., 1867, and Apr., 1868; Washington, D. C. Oct. 9, 1883, and Apr. 17, 1883, and Apr. 28, 1884.
<i>Microgaster carinata</i> Pack	<i>Pyrameis atalanta</i> L. Cambridge, Mass. (Scudder.)

Sub-family Agathidinæ.

<i>Agathis exoratus</i> Cr	<i>Eurycreon rantalis</i> Guen. on <i>Ambrosia</i> . Camden, Ark., July 6, 1888.
	Collected also in Texas, Mo., Mich., Wis.
<i>Agathis media</i> Cr	<i>Grapholitha ninana</i> Riley on <i>Acacia felicina</i> . Fort Huachuaca, Ariz., June 20-27, 1883.
<i>Microdus sanctus</i> Say	<i>Tortricid</i> borer in stem of <i>Ambrosia</i> . Washington, D. C., Aug. 25, 1886.
	Collected also in Texas, Mich., S. C.
<i>Microdus laticinctus</i> Cr	<i>Tmetocera ocellana</i> Schiff. on Apple. Washington, D. C., June 10, 1879; Canada, July, 1870.
<i>Microdus tortricis</i> Ashm	<i>Tortricid</i> on Blackberry. Washington, D. C., Dec. 16, 1885.
	Leaf-folder on <i>Viburnum</i> . Kirkwood, Mo., June 2, 1886.
<i>Microdus grapholithæ</i> Ashm	<i>Grapholitha malachitana</i> Zell. Kirkwood, Mo.
<i>Microdus albicinctus</i> Ashm	<i>Tortricid</i> on Chestnut. Kirkwood, Mo., June 20, 1886.
<i>Microdus agilis</i> Cr	<i>Cacæcia rileyana</i> Gr. on Hickory. Glenwood, Mo., May, 1868.
	<i>Cacæcia infumatana</i> Zell. on Hickory. Iron Mountain, Mo., June 10, 1869.
	<i>Botis erectalis</i> Grt., on <i>Polygonum</i> . St. Louis, Mo., Sept., 1873.

<i>Parasites.</i>	<i>Hosts.</i>
<i>Microdus agilis</i> Cr.....	<i>Gelechia absconditella</i> Walk., on <i>Polygonum acre</i> . Washington, D. C., May 26, 1884.
<i>Microdus melanocephalus</i> Riley, MS.	<i>Padisca</i> sp.? on <i>Solidago lanceolata</i> . Washington, D. C., June 12-17.
<i>Microdus cinctus</i> Cr.....	<i>Tineid</i> on <i>Cephalanthus occidentalis</i> . Washington, D. C., June 3 and 28, 1884.
<i>Microdus bicolor</i> ? Prov.....	<i>Cecidomyiid</i> in cone of <i>Abies bracteata</i> . Jolon, Cal., Sept. 8, 1880.
<i>Microdus simillimus</i> Cr.....	<i>Padisca strenuana</i> Walk., on <i>Ambrosia</i> . St. Louis, Mo., 1873.
<i>Microdus calcaratus</i> Cr.....	<i>Cecidomyia</i> on Sensitive plant. Fort Huachuaca, Ariz., June 27, 1883.
<i>Microdus earinoides</i> Cr.....	<i>Tmetocera ocellana</i> Schiff., on Apple. Canada, July 20, 1870. <i>Coleophora cinerella</i> ? Cham., on <i>Alnus</i> . Washington, D. C., Apr. 10, 1884.

HOW ARE INSECT VIVARIA TO BE LIGHTED ?

By A. H. SWINTON, *Bedford, England.*

Knowledge means advance. Of late years the addition of an insect vivarium to zoological collections has pressed itself on the public notice, and, as the scientist knows and feels, the want of an efficient receptacle in which to study the habits of winged insects has for long been with him a desideratum ; but I can not think from those articles that I have chanced from time to time to read that any one has been at much pains to contend with the outstanding difficulty, that of illumination. To many this subject may appear futile, others may have reputed it, perhaps impious, but experience teaches. As I have a fancy for a night moth or a butterfly flying about my apartment when engaged in reading, I have never failed to detect their invariable tendency to flutter over the window pane, save when the evening lamp has diffused a radiance, and then the moths circle around it or go a bumping against the whitewashed ceiling, the geometrid moths, perhaps, of the undomesticated kind appearing most at their ease. Evidently the second conditions here are most favorable ; a vivarium should be diffusely illuminated, and probably the walls and ceiling should be blackened. But what would happen were the illumination from the floor and the same were covered over with flowering plants ? Would not such an arrangement be congenial to butterflies whose glance is ever upward ; and in the case of thick-bodied moths that are prone to flap along the ground, ought not the source of light here to be central, raised, and masked by a dark transparent shade ?

It is a vulgar notion that the hot-house, lighted on its four surfaces or five, is a suitable vivarium, when it is most palpable that the butterflies and moths instead of displaying their habits merely flutter over the

sashes; and then when we learn to know species by their habits, what a real advance it is! I have of late been astonished with the supposed longevity of *Gonoptera libatrix*. I brought a hybernating individual into my apartment (which is high up, and looks into the road, and is in every wise isolated) the winter before last. During the mild spells of weather it would frequently circumvent the room at dusk, but it did not come out of its hiding on the influx of spring. I reputed it to be dead, when, to my astonishment, at midwinter I again saw a *libatrix*. I must repute it to be one and the same which came forth like a ghost and circumvented the room as before. What a marvellous thing is insect vitality and who knows its limits?

EXTRACTS FROM CORRESPONDENCE.

A Rose Pest.

The inclosed insect, or rather the worm which preceded it, has become very destructive to the roses in our greenhouses. Its habit is, whenever it can draw a leaf up against a bud, to do so and feed on the bud, ruining it in a night. Sometimes they get under the petals of the larger buds, which soon fade. We should like to know its true name and if there is a remedy for the evil, which is becoming very serious with us. Only a part of our rose-houses so far have been infested. We have supposed that by removing the soil from the top of the beds we might get rid of it, but do not know how deep they work into the soil. Any information you can give or reliable authorities you can refer us to will be highly appreciated.—[Wilter & Co., Denver, Colo., May 5, 1890.]

REPLY.—I beg to acknowledge the receipt of yours of the 5th inst., together with the accompanying specimen of a moth reared from a caterpillar damaging roses. This moth is the species known as *Cacœcia argyrospila*. It is a common species throughout the whole country and feeds in the larval state upon horse-chestnuts-roses, apple, hickory, oak, soft maple, elm, and wild cherry. You ought to have little difficulty in destroying it in your greenhouse by spraying your plants about the time they are expected to appear with Paris green in the proportion of a table-spoon, full to a large bucket of water. You will gain nothing by removing the soil from the top of the beds, as this species does not enter the ground in any stage of its existence. It transforms to the pupa state within the leaf-roll. Of course some good can be accomplished by picking, but in the case of an extensive greenhouse I would advise arsenical spray.—[May 13, 1890.]

A Parasite of *Agrilus*.—The Lady-bird Parasite.

Enclosed you will find the cocoons (No. 1), larva (No. 2), and imago (No. 3), of an ichneumon fly, which I suppose to be a parasite of *Agrilus ruficollis*.

The female fly (No. 3) emerged April 7, from one of a number of cocoons like No. 1, taken March 11, from the raspberry gouty galls at the end of a mine where the larva of *A. ruficollis* had perished, it having emerged from the side of the cocoon and not from the end as is usual, and as there are yet larvæ in some of the cocoons taken at the same time I do not know if this is the original parasite or a secondary one. Will you please give me your opinion on the subject?

Two examples emerged on the 7th of April, a male and female. In making drawings of them I dissected the male and was not careful in preparing the female (No. 3), thinking I would have plenty of examples when the others emerged. As I

can not wait longer for others, I send you what you will find inclosed, hoping they will be sufficient for you to identify the species. I am preparing a report on *A. ruficollis* for our Experiment Station, and due credit will be given in my report.

I have been studying the life history of *A. ruficollis* for over a year, have examined hundreds of canes of the red and black raspberry, the blackberry, and dewberry, and on March 11, 1890, I discovered for the first time that the *Agrilus* larvæ had all been destroyed in my black cap raspberry canes. I have not, however, found a single one of these parasite cocoons in the wild blackberry briars where the *Agrilus* larvæ are quite plentiful.

Yesterday, May 8, I found a lady-bird (*Hippodamia maculata*) on a clover leaf attached to the cocoon of its parasite, *Centistes americana* (INSECT LIFE, Vol. I, No. 4, p. 103). As there seems to be some doubt as to where the parasite larva makes its exit from the body of the Coccinellid, I made a thorough examination of this specimen (which you will find inclosed in the quill, No. 4) while it was yet alive. On opening the elytra the abdomen was easily tipped back, readily separating from the metasternum, causing me to believe that this thoracico-abdominal suture is really the place of exit, as suggested by you on page 102, INSECT LIFE, as above. The form of the anterior abdominal segment would naturally cause the abdomen to tip back or up when the larva would attempt to force its way out at this point. I found another parasitized specimen to-day, attached to the bark of an apple-tree, the same conditions existing as with the one I send you.

I also inclose you another example of an insect, being impressed in paper, for your inspection. It was taken from a late bulletin of the South Dakota Experiment Station.—[A. D. Hopkins, Kanawha Station, W. Va., May 9, 1890.]

REPLY.—The parasite which you have reared from *Agrilus ruficollis* is a new species of the genus *Bracon*.

It is in all probability a primary parasite, as the species of this genus are reared from Coleopterous larvæ. I hardly know what to make of your statement that it issued from the side of its cocoon and not from the end, but will keep the three cocoons to observe the issuing of other specimens. The parasite on *Hippodamia maculata* you will find is the species described by Professor Riley on page 338 of Vol. I of INSECT LIFE, as *Perilitus americanus*.

You are unquestionably correct in your opinion as to the point of issuance of this larva from the Lady-bird. I regret to state that your insect impressed in paper could not be found in your envelope. Did you omit to send it?—[May 13, 1890.]

The Tent Caterpillar.

Our town (Barrington, R. I.) is infested with the Tent Caterpillar (*Clisiocampa americana*). Every wild-cherry tree in the town is covered with them. At the last meeting of the Improvement Society the propriety of cutting down the wild-cherry trees was discussed. Some thought the cherry-trees attracted them from fruit-trees, and that it was better to kill the caterpillars and leave the cherry-trees; others thought the trees were breeding places for the caterpillars, and consequently largely increased their numbers. Which is right?—[J. H. Griffith, Barrington, R. I., May 14, 1890.]

REPLY.—Your favor of the 14th inst., relative to the Tent Caterpillar, has been received. The answer to your question depends, I should imagine, largely upon the number of wild-cherry trees in the vicinity of your orchards. Supposing that the wild-cherry trees are very numerous and that the caterpillars are allowed to breed upon them unmolested, the numbers of the pests will undoubtedly increase upon this their favorite food plant, and the overflow will spread to the orchards. If, however, the number is very small it will pay to allow them to remain, provided some measures are taken for destroying the worms as fast as their tents become perceptible. Where there are only a few wild-cherry trees they will always be infested, and the moths will always lay their eggs upon them in preference to other trees. On account

of their small number they can be readily watched and easily treated, either by burning the webs or by spraying with an arsenical poison. I should think, then, that it is an advantage to have a very few wild-cherry trees near an orchard and a disadvantage to have a large number. The eggs are so easily seen on the cherry-tree in winter that the pruning and burning of these is one of the best preventive measures.—[May 16, 1890.]

The Horn Fly.

The Horn Fly has made its appearance again in considerable numbers and is annoying our cattle greatly. I can apply the train-oil to the dairy cows in their stalls, but it is exceedingly troublesome, not to say difficult, to apply it to the comparatively wild field cattle and steers. Can an emulsion be made of it, so as to apply it to the cattle with our tree-spraying pumps? And if so, in what way is it best done? It is impracticable in our large fields, many of them including woods, to apply lime to the droppings, as recommended in the special bulletin on the Horn Fly, issued in 1889.—[H. M. Magruder, Charlottesville, Va., May 12, 1890.]

REPLY.—Your letter of the 12th May has come to hand. There ought to be no difficulty in making the emulsion of train-oil with soap, so as to be able to apply it with a spray pump; but I am of the opinion that it will be difficult to apply in a spray thoroughly enough to cattle in the fields to keep the flies off for any length of time. However, as you seem desirous of trying the experiment, I shall be very glad indeed to learn the result. To emulsify the train-oil satisfactorily it will only be necessary to prepare it according to the inclosed formula, simply substituting train-oil for kerosene. In spite of your statement that it is impracticable in your large fields to apply lime to the droppings it seems to me a great deal of good can be accomplished at just this time of the year. If the flies are just appearing they will soon begin to lay their eggs and the numbers of subsequent generations can be greatly reduced if only a portion of the dung is limed. Are there not certain points in the field where the cattle stand through the heat of the day and where the dung can be limed?—[May 13, 1890.]

A Jack Rabbit Parasite.

I should like to call your attention to a parasite that infests the Jack Rabbits of this country, and in view of the fact that the Australian Government offers a large reward for the destruction of rabbits in that country it may be that this parasite would be just the right thing. It occurs in the shape of a large lump on the back, hips, and thighs. Upon examination it seems to be made up of innumerable small transparent sacs, which are held together in rows. The lump gets larger and others appear and finally the rabbit dies. If this parasite is unknown to scientific men I would take pleasure in sending you specimens in alcohol or as you may direct. I believe this country would be overrun with rabbits were it not for this parasite. But it does not kill them all, and it may be that it does not kill them at all, but I frequently find them dead from some cause.—[D. G. Sherrard, Burnet, Burnet County, Tex., May 3, 1890.]

REPLY.—I beg to acknowledge the receipt of yours of the 5th inst. There are several species of true "Bots" which infest rabbits, although I am not aware that any species is specifically confined to the "Jack Rabbit," nor am I at all certain that the parasite which you mention is a Bot. The matter can be readily settled, viz., send specimens in alcohol. Please see that the bottle is carefully packed in sawdust, and if you will forward by express, all charges will be paid at this end. Please mark the package with your name.—[May 13, 1890.]

Supposed Bed-bugs under Bark of Trees.

In No. 4, volume 2, INSECT LIFE, page 106, regarding the "Bed-bug" (*Acanthia lectularia* L.), I will say that I have seen the "bug" under the bark of the Cottonwood (*Populus monilifera*) in many places in the West, and more especially along the

Big Horn and Little Big Horn Rivers in Montana; by pulling off the bark of the dead trees they would be found in numbers. The question occurred to me "what they lived on;" they were not dull, but perfectly lively as soon as exposed to the light.—[S. M. Swigert, captain, Second Cavalry, U. S. Army, Fort Leavenworth, Kans., May 10, 1890.]

REPLY.—Your letter of May 10 has just come to hand. I have known for some time that the domestic Bed-bug will live for a long time, even for years, in locations where buildings have once stood or in spots where there have been camps in the woods. But it seems more likely to me that the insect which you have found under the bark of the Cotton-wood is not the true Bed-bug, but that it is another quite similar bug of the genus *Aradus*, the species of which are often found in such localities, and which, before they have attained their full size, strongly resemble the Bed-bug. I can settle this point for you if you will take the trouble to send in specimens —[May 13, 1890.]

The Orchid *Isosoma* again.

Since the receipt of your letter, etc., concerning the Orchid *Isosoma*, about which I made inquiries last fall, I have endeavored to make observations and obtain more material, but, owing to the previous vigilance of the florist who was troubled by it, I have not been able to do so. He has given me, however, a number of roots of *Cattleya gigas* affected with galls containing, I think, dipterous larvæ. Those I have opened contained from one to seven maggots, separated from each other by the substance of the root. I inclose some for your inspection. As you will see, the galls are situated near the tips of the roots. The trouble seems to have been introduced on a plant from England last year, and to have spread to a few plants hanging nearest that one. Owing to the costly character of the plants affected by this pest as well as the *Isosoma*, all insects attacking them are destroyed as soon as discovered, but I am trying to obtain as much material as possible.—[Albert P. Morse, South Natick, Mass., May 8, 1890.]

REPLY.—Yours of the 8th instant, with maggots found in galls on roots of *Cattleya gigas*, has been received. These are the larvæ of a species of *Cecidomyia*, or of the allied genus *Diplosis*. I can tell you nothing more until the adult flies are reared. As you will notice in my note in INSECT LIFE, copy of which I sent you some time since, some skepticism exists among English entomologists for the very reason that Dipterous galls occur upon these Orchids, and the *Isosomas* have been considered by them as their guest flies or parasites. This, moreover, would be strengthened by the fact that we can unquestionably separate *I. orchidearum* from the restricted genus *Isosoma*, which is composed entirely of phytophagic species, were it not for the fact, as I also state upon page 121 of Vol. I of INSECT LIFE, that the larvæ have been watched by me in all stages and observed to feed upon the orchid substance, and that the cavity made at first is only just large enough to contain it and its frass. I am glad that you are interesting yourself in this matter, and hope that you will indicate your further observations to me for the benefit of the readers of INSECT LIFE.—[May 12, 1890.]

Eristalis in Well Water.

I send by mail to-day a specimen of a small worm that infests a well at this place. Ordinary cleaning of the well does not get rid of them, but they quickly redevelop, so that one bucket of water will frequently contain three or four. As a matter of course the water is not used for drinking purposes, but the proprietor would like to use it and be freed from these pests.—[Dr. D. B. Frontis, Johnston, Edgefield County, S. C., May 7, 1890.]

REPLY.—The maggots which are infesting the well in your town are those of a Syrphid fly of the genus *Eristalis* and probably belong to the species known as *E. tenax*. These larvæ, together with those of several allied genera, have long been known to live in decaying vegetable matter, in manure, or in soft mud impregnated

with decaying vegetable matter, and I should say off-hand, without an examination of the well, that the very presence of these larvæ indicates that the water is not fit to drink. If the well were perfectly clean and the water pure I believe that these larvæ would not be present, consequently cleanly measures are the ones which will bring relief. The eggs are laid by a two-winged fly which frequents flowers.—[May 12, 1890.]

The Bryobia Household Pest.

In the summer of 1888 I found a bay window swarming with red spider. I had them cleaned down, the window washed outside and within. In a few days everything was as bad as before. I again had it cleaned and rubbed—glass, casing, and above, on the outside, with kerosene. As soon as the kerosene had dried out I was afflicted as before. By this time I had discovered they were more or less on every window with a northern aspect; they were also on the carpet, webbing from the floor onto the base boards, and on the wall under the window-sills, where I could not use kerosene. They were in the drapery, and could not be brushed off without soiling it. The only way was to hang it out, when they would drop off.

Being very sensitive about "insect life" about my premises, having always kept clear of it, it took some courage for me even to hint the case to my neighbor 20 rods away, and find out if she had seen the like. We examined her house thoroughly on the northern side, and found no sign of it; nor could I ever hear of or see, peer round as much as I would, a case during that summer; and so I concluded my house was the only one whose door posts were not marked when the plague passed by. In order to keep them down, I can not say clear of them, I sprinkled the carpet and every thing that would not bear kerosene with gasoline, using perhaps a pint, being sure there was no fire in the house, nor like to be before it would evaporate. Every morning as soon as breakfast was over, I drew a broad line of kerosene across the whole northern side of the house, sprinkled the ground with carbolic acid and water. I found dandelions loaded with the spider; while across the path 3 feet wide, in the sun, there were none on the dandelions. At that time I supposed it was the result of setting house plants troubled with red spider out on the north of the house in 1880-1882, not since.

In 1889 I saw two houses where rooms of northern aspect were troubled with them. One was a house in which was no tenant, and in a week after it had been newly painted (ecru-colored paint), newly papered, and well calcimined, it was a sight which would drive a careful housekeeper to despair.

The last case that came to my notice was in December, 1889, after we had had a hard freeze (3 degrees below), then very mild weather. A lady and her husband, spending the evening, told of the plague of red spider just infesting their house; they had never seen anything like it. This was on the northeast side of their house.—[Mrs. H. S. Perry, Elgin, Ill., May 5, 1890.]

REPLY.—Your letter of May 5, giving an account of your experience with the so-called "red spider" has been received. We are very much obliged to you for the trouble you have taken in sending this account, which we shall take pleasure in publishing in a near number of INSECT LIFE. An account of any further experience, should these creatures bother you again, will be thankfully received.—[May 12, 1890.]

Florida Orange Scales in California.

We are somewhat alarmed at the great quantities of imported Florida trees that have of late been brought into the State largely infested with the Florida scales, notably the Long Scale (*Mytilaspis gloverii*), the Purple Scale (*Mytilaspis citricola*), and the Chaff Scale (*Parlatoria pergandei*), and also the Florida Red Scale (*Aspidiotus ficus*). I inclose you some leaves taken from trees planted a year ago at Downey. Knowing

that you are familiar with these insects, having lived in the Magnolia State, I would consider it a very great favor if you will briefly answer the following questions:

First. How destructive is the Purple Chaff and Long Scale? That is, what are the general characteristics of an infected tree and its fruit? How does the tree show being infected? Some claim here that the leaves curl, turn yellow, and drop off, and that the tender growth dies and the tree presents the appearance of having been scorched by fire.

Second. What is the best means of exterminating them? Do you consider dipping and the gas remedy previous to planting absolute proof against scale? Is absolute quarantine the only safe and sure means of freeing the country from this new and now threatening invasion of insect pests?

Third. The statement is often made here that the Florida Scales will not live in this dry climate. San Bernardino lays particular stress upon this point. Livescales (Purple and Chaff) have been found on trees planted a year at Pomona, and it would seem that if they thrived there the chances of their living and breeding at Riverside and San Bernardino are rather good.

In your opinion will they not live and thrive in any portion of California where the citrus fruits flourish? If not, what localities are peculiarly adapted to their well-being?

Fourth. How rapidly do they spread, and when is their breeding season.

Any other information that you can furnish touching this subject will be appreciated. The growers here are becoming seriously alarmed.—[Henry W. Kruckeberg, Los Angeles, California, April 21, 1890, to Mr. Albert Koebele.

REPLY.—Mr. Albert Koebele has referred to me your letter of the 21st ultimo, together with the specimens which you sent him. The insect which you forwarded and which has been imported into your State upon trees from Florida is the common Purple Scale (*Mytilaspis citricola*). This is one of the worst of the Florida scales, although not equaling in severity of its attack the San José Scale, the White Scale, or the Red Scale of California. Its effects in extreme cases are like what you describe. The question as to the possible spread of this insect in California is one which is difficult to decide without absolute experimentation. I am familiar with the idea that has been frequently expressed that these scale insects die out after the first year in California, but should be inclined to doubt it were it not for the fact that while this insect must have been frequently imported it has never taken hold. It is kept in subjection in Florida by horticulturists by the kerosene emulsion made according to the Hubbard formula, a copy of which is inclosed on a separate sheet. The young lice begin to hatch in March.

There is another brood in July and a third in September or October, and it is at the time of the hatching of the eggs and the migration of the young that the emulsion is applied with the best results. Some modification of the life-history of the species is to be expected if it establishes itself in California. The rapidity of the spread of this and allied species can be gauged by that of any scale-insect. Unless assisted artificially it is slow on account of the fact that the female is wingless.

I think there is no cause for serious alarm, for these scales are handled with comparative ease, and the fact that they have not already established themselves in California is somewhat of an argument against their accidental colonization in that State.—[May 6, 1890.]

ANOTHER LETTER.—I spent a day and a half at Riverside, and was shown around by Dr. Claffin, the horticultural commissioner for that district, but I found no Florida scales, except on some orange trees planted out the present season. They have the most thorough system of inspection and of disinfection of any I ever saw. Dr. Claffin informed me that they employ eight inspectors at a salary of \$3 per day. During the past two years every plant, shrub, and tree growing in the Riverside district has been carefully inspected, and whenever a scale of any kind was found prompt measures were at once taken to destroy it. When only a few scales were found on a tree the twigs

or branches on which they are located are cut out and burned, but if the scales are quite numerous on the tree the trunk of the tree is marked with chalk, and the owner of the tree is notified to spray the tree. After the lapse of about two months the trees which were marked are again carefully inspected, and if any live scales are found on them are ordered sprayed; and this warfare is kept up until the inspectors are unable to find a single living scale. I was informed that all of those who had been requested to spray their trees did so at once, everybody being anxious to aid the inspectors in getting rid of the scales. As an illustration of what is being accomplished in this direction I may mention a certain orange grove some twelve or fourteen years old in which at the first inspection about forty trees were found to be infested with scales, whereas at the last inspection scales were found on only *six* of the trees.

Such results as this are encouraging indeed, and indicate what well-directed efforts, backed by public opinion, will accomplish.—[D. W. Coquillett, Los Angeles, Cal., May 9, 1890.]

The Larva of the Ox Bot-fly.

Regarding *Hypoderma bovis* I shall read the account of the discovery of Dr. Cooper Curtice with great attention. If I understand rightly you have not yet developed the imago, and the point is occurring to me whether it lies in the compass of possibility that these larvæ can belong to *Cuterebra americana* Fab. I scarcely like to venture even to suggest this, for your personal knowledge of this genus will be probably just in inverse ratio to my ignorance, but looking at Brauer's descriptions and figure of *generic* type of *larvæ*, the idea has entered my mind.

I think I may safely say that the form of attack would be quite abnormal to *H. bovis* in this country. As the point is of so much interest allow me to submit my reasons to you from about six years' observations. I think that the larva penetrates from the exterior to its location beneath the hide, because I have found an excessively minute channel leading down from the outside to where the minute larva lay below, and when I squeezed the fragment, blood ran up this channel, but I did not see any other passage from the torn and bloody hole in which the minute larva lay. Also I found a channel *partly* down from the outside occupied at the lowest part by what appeared to me certainly (though too much crushed for me to say it *was* so) to be a larva. I have uniformly, so far as I can remember, found the *H. bovis* larvæ with the caudal extremity uppermost, and their extraordinary powers of self-inflation, and non-power of rejection of contents to tangible extent at the time when in this country they are forming the cell by pressure, seems to me to account for this part of the effects of their presence. * * *—[Eleanor A. Ormerod, Torrington House, St. Albans, England, March 10, 1890.]

REPLY.—In reference to Dr. Curtice's discovery in relation to the *Hypoderma*, I have little to say beyond what I stated editorially in INSECT LIFE. There is no chance of the larva which he refers to being a species of *Cuterebra*, but until it is reared we can not say positively that it can not be another species of *Hypoderma*, though the chances are all against this even. Dr. Curtice is going to make every effort to rear it, but you can, from the very nature of the case, see how difficult, if not impossible, this is. It is not only from my own observations, but because of your own careful researches, as recorded, that I have felt so positive that the very normal habit of *Hypoderma bovis* larva is to penetrate from the exterior of the skin of the animal, and the case observed by Dr. Curtice is, in my judgment, exceptional.—[May 1, 1890.]

The Fuchsia Beetle.

Will you be so kind as to answer a question for us concerning the Fuchsia Beetle? Would there likely be larvæ of the insect in the ground in the spot where the beetle was very troublesome last year on fuchsia, or does the great swarm that annually makes its appearance come from some other locality?

We are going to try growing our fuchsia under a wire gauze guard this summer and wanted information on the above point before we located the bed in the same spot again.—[Ernest Walker, New Albany, Ind., May 17, 1890.]

REPLY.—The insect which you know as the fuchsia beetle (*Graptodera exapta*) feeds in the larval state upon the leaves of fire-weed (*Erechthites hieracifolia*) and the Evening Primrose (*Enothera biennis*), and it is probable that the swarms which attack your fuchsias have developed on these plants. I shall be interested to know whether in your vicinity (New Albany) either of these plants is abundant. Your plan for growing fuchsias under wire is a good one.—[May 24, 1890.]

SECOND LETTER.—Many thanks for your communication of 24th; the information it contains will be of great value.

The Evening Primrose (*Enothera biennis*) was very abundant last year in this locality. One field that had been under cultivation for a long time and then neglected for a season, came up the following year (which was the summer of 1889) a solid mass (almost) of the Primrose. There were also scattering patches of the Primrose in fields adjoining our nursery grounds. The Fuchsia Beetle was more troublesome last year than any other year in our experience. They, in spite of all our efforts, staid with us almost through the summer. They were also troublesome in private gardens in the city—most all lost their plants long before summer was over. We saved a few this year. The fuchsia sold very poorly on account of the trouble last year. The Fire-weed (*Erechthites hieracifolia*) I have not yet met with in this vicinity.—[Ernest Walker, New Albany, Ind., May —, 1890.]

Parasites on *Datana ministra*.

Mr. Webster, I think, only saw one-half the show, as told in his notes on the parasitism of the larva of this moth, as given on page 256, of Nos. 7 and 8, Vol. II of INSECT LIFE, by a Tachina Fly.

In all cases where I have observed the Fly ovipositing in the larva on the ground, Ichneumon Wasps were ovipositing in them on the trees.

The Ichneumon would deposit one egg in a larva on the tree, when it would flip up and drop to the ground, where the Tachina Fly would meet it and further make its life a burden to it. I have often observed the same actions of these parasites on the larva of the *Datana* moth when feeding on the foliage of the apple. I never observed the Tachina Fly attack the larva on the tree.

Once on nearing an apple tree partially defoliated by this larva, I saw a Box Land Turtle, such as we clod-hoppers in Illinois called "Terrapins," directly under the cluster of caterpillars, which an Ichneumon was industriously laying her eggs in. As I neared the tree I saw her pierce a larva, which bounced into the air and fell to the ground near the Turtle's head, she struck two or three more, which also fell. I expected to see the Turtle gather them in, and waited quite a time to see him feed on them, as he seemed to be there with that intention.

Thinking that my proximity was interfering with his lunch, I walked directly away and came up carefully behind another apple-tree twenty feet away, and peeped through the foliage; directly the Turtle snapped up the five or six larvæ on the ground, and then gathered in others the instant they touched the ground.

This Land Turtle seems to be quite omnivorous; they feed on strawberries voraciously. The above is the only case observed by myself of its feeding on insects.

I have seen a large black wasp sting a full-grown *Datana* larva, which paralyzed it instantly, and then carry it off a long distance over the ground, and bury it in a hole in the ground which she had already dug; two days after, on digging it up, found she had laid an egg under it which was not yet hatched. The caterpillar seemed yet to have life and some motion, as if in a comatose condition.

Luckily but very few *Datana* larvæ escape the parasites; if they did the Black Walnut and Apple could hardly be grown, for they defoliate these trees at the most critical period of the year.

A young Apple-tree entirely defoliated by them in August shows no visible effects above ground, will pass the winter; the buds will swell the next spring, wither, and, if the tree is taken up, it will be found to have no live roots whatever; and, curiously, so far as my observation goes, the smooth form of the *Datana* larva which feeds on the Apple, does not seem to be as liable to parasitism as the *hairy* form that feeds on the Black Walnut, and the Apple-tree form is at least one-third larger when full-grown.—[D. B. Wier, Petaluma, Cal., May, 1890.]

A Tineid (*Anaphora popeanella* Clem.) injuring Indian Corn.

I send you by mail specimens of larvæ that are injuring the young plants of Indian Corn to a great extent in this and adjoining States. They are most abundant on sod lands of first year's planting, from one to three being found in each hill, and from my first observation of them when about one quarter of an inch long up to $1\frac{1}{4}$ inches they live in burrows lined with fine filaments of silk-like structure, the alley-ways being often as deep as 4 or 5 inches in the ground and 2 or 3 long on the surface. When they reach a hill of corn they surround the base of each plant with a fine web mixed with earth pellets, building it up to the lower blade which they slowly eat away. As they get larger they eat the stripped plant to the ground. They are shy, retreating to the bottom of their burrows on the least noise. If half a dozen are placed together they are belligerent, biting each other. Their color is light brown, not striped, and they are covered with a thick coat of microscopic hairs, finer as the larvæ get older. The specimens I send you have undergone their third molt. I have noticed them here for several years, but not in injurious numbers till the present season in this section. I am feeding a number of them so as to get the perfect insect and eggs if possible. Could you tell me what they are and something of their life-history?

The present summer I spent on the banks of the Saskatchewan River and was surprised to see the great number of *Danaïs archippus* in the month of September. Shrubs and small trees were covered with them in countless numbers. In the cool (almost frost) of the evening they could be shaken to the ground in a helpless, chilled condition, but became lively enough when the sun warmed them up. The Cree and Blackfoot Indians say the wind from the south brings them there. The specimens I send are in chloroform, which shrinks them a good deal, but I think will not destroy their distinctive characteristics.—[John C. Andras, Manchester, Ill., May 22, 1888.]

REPLY.—Your letter of the 22d inst., inclosing specimens of larvæ injuring Indian Corn, duly received. The specimens interest me very much, as they are new to science in the rôle of corn-feeders. They belong evidently to the Tineid genus *Anaphora*, but it will be impossible to determine the species without rearing the adult. I trust you will therefore assist us by sending us a large number of the living larvæ, as well as by carrying on the observations which you mention in the field. Your observation upon *Danaïs archippus* is very interesting, but has frequently been made before (see Vol. III, American Entomologist) —[May 26, 1888.]

SECOND LETTER.—I send you by mail some living larvæ, but fear they will hardly go through alive. I have had some difficulty in rearing them in captivity, as they seem to need the covered spun retreat into the ground and rather solitary habit. Though there may be a dozen destroying a hill of corn, each has his home, and on the least disturbance retreats to the lowest depths of his web-lined burrow. Their hearing is acute; I can not say whether by aural organs; it may be by vibrations of the ground from walking over it; but the sound of a light step will cause every head to retreat for several feet round. Their sight is good. I have stood perfectly still till a number round me would be eating, when with the lifting of a hand all would be out of sight in an instant. They feed in the evening, generally after 6. As the sun goes down those that have their home a short distance from a hill of corn will crawl to the nearest stalk and begin devouring it at once. As they increase in size they eat only next the ground, and you can often see a plant 6 inches high cut down in the early stage. The larvæ live on the small leaves and do not cut the stem of the corn. In loco-

tion they travel equally well backward or forward. As to the damage done by these larvæ it far exceeds, on new-plowed meadow-land, any pest that has visited this section for several years.

I visited 80 acres of corn yesterday afternoon that had been plowed once—corn about 4 to 6 inches high, that in a few days will be destroyed; there were from 1 to 20 larvæ in every hill and its vicinity. The *second* year from meadow is not entirely exempt from these pests, but on older plowed lands I do not find it. Of the enemies of the larvæ I find birds, the Crow, Black-bird and the Thrush, near hedges busy. Ants are busy destroying and driving the larvæ from their retreats. There may be two broods up to the present time as I find a few larvæ not over one-half an inch long that have only moulted once. After each change the larva comes out less hairy. My first observations began about April 10. My first captures of them when larvæ were about one-fourth of an inch long, and feeding entirely on the leaf of the early corn, cutting it in small holes. These larvæ never drag the cut-off leaf or plant into their retreat as the cut-worm does, but farmers attribute all the present destruction of corn to the corn "cut-worm" which has nothing to do with it. As soon as the larva changes into the pupa state I will send you some by mail so as to reach you safely. A very dry autumn and continued cold winter has been favorable for all insect life. * * *—[John C. Andras, Manchester, Ill., May 30, 1888.]

SECOND REPLY.—Letter and specimens acknowledged, and the latter determined to be *Anaphora popeanella* Clem.

GENERAL NOTES.

EFFECTS OF LONDON PURPLE ON FOLIAGE.

Our esteemed correspondent, Mr. J. Luther Bowers, of Herndon, Va., after considerable experience, makes the following estimate of the strength of solutions of London purple which different trees and shrubs can endure while in bloom without injury: Plums, English varieties, 1 pound of London purple to 160 gallons of water; apples and raspberries the same proportions; apricots, 1 pound to 200 gallons; cherries, 1 pound to 250 gallons; peaches, 1 pound to 300 gallons. Mr. Bowers further states that he has discarded Paris green and will always use London purple in future.

THE TULIP-TREE SCALE-INSECT.

The *Rural New Yorker* of May 10, 1890, contained a little editorial notice of the damage done by *Lecanium tulipifera* Cook with a rough figure of an infested limb. The tulip trees upon the Rural Grounds are said to be "now so disfigured by this disgusting insect that they will have to be destroyed. The branches are covered with the scales which resemble so many chronic sores. The infested branches first turn black, as if scorched by fire, and then die." The editorial mention concludes with the statement:

There is practically no way of fighting this insect. The kerosene emulsion, if applied at the right time, and at repeated intervals during two or three weeks, would, no doubt, afford a temporary relief.

This, it strikes us, is a very unsatisfactory way of dismissing the remedy question and we feel assured that a thorough treatment with the kerosene emulsion at the time when the young lice are hatching will prevent the spread of the insects and result in the recovery of the trees.

A NEW ENEMY TO RYE.

An entirely new and very injurious enemy to the Rye crop made its appearance in 1887 in St. Mary's County, Md. We have never published any account of it, awaiting its re-appearance. It has not, however, since been seen, and as the matter is of considerable interest we present this note. The pest was a small, active, rather hairy caterpillar which confined its attacks entirely to the heads of the grain. Mr. G. F. Dyer, of Leonardtown, to whom we were indebted for the specimens, wrote that he had 20 acres of rye from which he expected to harvest from 18 to 20 bushels per acre, but that the crop was entirely destroyed and was not worth harvesting except for the straw. He had about 20 acres of wheat in the same field but this crop was not touched. The field in question was not in cultivation last year, but in 1885 was planted with corn and tobacco. The larva is small measuring but a trifle more than a quarter of an inch in length when full grown. It is yellowish in color and is marked with two broad brown bands down the back, and two narrower ones nearer the sides. The back is also furnished with a number of large yellowish warts, six to each joint, from each of which comes a bunch of stiff hairs.

The work of the larva is very thorough. Nearly every grain is bored into by a circular hole through its sheath and the contents eaten out more or less completely. Mr. Dyer counted as many as seven larvæ upon a single head and each larva must destroy a number of grains in the course of its growth. Before transforming to pupa the larva spins for itself a moderately strong silken cocoon, covering it with spiny bits of the seed sheaths and attaches it to the head of the grain. It remains in the pupa state not more than a week or ten days, when the adult insect, a small white moth slightly marked with slate-color towards the tip of the wings, emerges. The adult is a species of the interesting genus *Nola*, and is closely related to *Nola sorghiella* Riley, described in the annual report of the Entomologist (Rep. Dept. Agr., 1881-'82, pp. 187-189), and which was reared from Sorghum from Alabama.

The habits of this insect, so far as learned, render it easy to subdue, as it spun its cocoons and transformed with considerable regularity just at the time of harvest. We therefore advised Mr. Dyer to thresh his grain immediately after harvest, for if this course were followed the helpless pupæ attached to the heads would be crushed and the next generation of the insect would be practically "nipped in the bud."

From the fact that the land was not cultivated the previous season it becomes probable that the normal food of this insect is some unculti-

vated plant, and that this damage to rye is to a great extent abnormal. The very thoroughness with which Mr. Dyer carried out our recommendations probably accounts for the subsequent non-appearance of the insect.

SOME CASES OF AUSTRALIAN SPIDER BITES.

The following cases have been kindly collected and sent to us by Mr. C. O. Montrose, of Melbourne :

A Rutherglen exchange states that a lad named Thomas Johnson, 18 years of age, was bitten by a spider last Tuesday morning while putting his hand into a bag for fowl feed. The insect had, according to the lad's account, apparently been knocked down with his web when he moved the bag. It seems to have got underneath his shirt at the neck and dropped down to the waist, where it inflicted two bites. He did not notice these much. But it then got into his sleeve and bit him on the elbow. Most excruciating pain and sickness immediately succeeded, and he pluckily procured a horse and rode into Corowa, occupying only two and one-half hours in covering 30 miles. On arrival at the Newmarket Hotel he was foaming at the mouth and most violent in his behavior. He offered the most strenuous resistance to being secured, but was at length overcome. Dr. Lang was called in and for a time the patient's chances hung in the balance between life and death, but the treatment ultimately prevailed, and he was moving about on Wednesday.—*Melbourne Herald*, January 11, 1890.

Another case of serious results from the bite of a spider is reported. Mr. Joseph Chicken, proprietor of the Netherby Mills, Corowa, was bitten by a spider near the top of the thigh. He thought little of the occurrence at the time, and mounting his horse commenced to ride out of town. He had not proceeded far, however, when the pain arising from the slight wound became very severe, indeed, and after enduring it for a few hours Mr. Chicken had to return home. He passed a terrible night. The pain extended to the extremities, and the patient was in a most feverish state. Under medical care he is now recovering.—*Melbourne Herald*, January 18, 1890.

Mr. M'Donald, of Corowa, manager of Goonambil, was last week bitten by a spider of the red and black species, and for two days suffered severely. Mr. W. Squires and Mr. Geo. Parkin have both been laid up suffering from the same cause. Other cases are reported from different parts of this district.—*Town and Country Journal* (Sydney), February 8, 1890.

Mr. Giles, one of our farmers here, was bitten by a black spider in the palm of the right hand. The bite assumed such bad poisonous symptoms that he had to seek medical aid. We are glad to say that he is now getting right again.—*Minyih, Victoria*.

THE NEW VINE PEST IN NEW SOUTH WALES.

We have noticed many accounts in the Australian newspapers of the occurrence in great numbers of the new pest to the vine, mentioned on p. 381 of vol. ii. It has been determined by Mr. Skuse as a species of *Phytocoris*, and extensive experiments have been made under the direction of the Government entomologist, Mr. French, with the result that benzole strong proved to be the most efficacious remedy. An emulsion of this substance has not been made, but one part is mixed with a similar quantity of water and violently agitated to keep mixed.

In this proportion it does no injury to the foliage and instantly destroys every bug which it touches.

BARBADOES SUGAR-CANE MITES.

In Bulletin No. 40 of the Royal Kew Gardens (April, 1890) Mr. A. D. Michael reports upon the mites found on samples of diseased sugar-cane sent from Barbadoes by Mr. John R. Bovell, superintendent of the Dodd's Botanical Station. According to Mr. Bovell, cane affected with mites yields only one ton of sugar per acre as against three tons per acre from healthy cane grown on the same estates under the same conditions. Mr. Michael found upon the canes four classes of mites, viz: (1) *Histiostoma rostriserratus*, a follower of decay. (2) Several immature Gamasids, predaceous species. (3) *Damæus* or *Notaspis* sp., in small numbers only. (4) Two species of *Tarsonymus*, the larger of the two being identical with the species found by Dr. Bancroft destroying sugar-cane in Queensland. For this is proposed the name *Tarsonymus bancrofti*. This is the principal enemy.

As remedies Mr. Michael recommends Dr. Bancroft's plan of steeping the canes before planting for twenty-four hours in a solution of 1 pound carbolic acid to 100 gallons of water, and suggests the use of a mixture of powdered sulphur in soap and water. This application should be made two or three times at intervals of a fortnight. Burning the débris is also recommended.

A REMEDY FOR CABBAGE WORMS.

Mr. A. S. Fuller, agricultural editor of the *New York Sun*, finds that the following treatment deters the Cabbage Worm:

Two quarts of coal-tar are put into an open vessel, which is set in the bottom of a barrel, and the barrel is filled with water. In forty-eight hours the water is impregnated with the odor of the tar, although tar is not dissolved in it. The water is then sprinkled abundantly on the cabbages, and the odor penetrates every portion of the head, killing or driving away the worms. As the water evaporates, no stain or odor remains on the cabbage. The same quantity of coal-tar can be made to impregnate several successive barrels of water.

LONDON PURPLE.

The *Gardeners' Chronicle* of February 15, 1889, published an article under this caption which shows that London purple is less known in London perhaps than in any other place. Spraying with this substance having been urged in this journal, some of its correspondents wrote to inquire what it was and where it could be had. The editors surmised it to be an arsenical preparation, and were sure that they could find references to it in any authorized dictionary of chemistry or pharmacy. They were disappointed, however, and then applied to chemical authorities, "to scientific chemists of high repute, to manufacturing chemists, pharmacists, but all to no avail. Finally Mr. Holmes, of the Pharma-

ceutical Society, furnished the desired information. In the meanwhile, however, finding that in London they could get no information as to London purple, they tried London, Canada, and finally wrote to us in Washington. The morals which they draw from the story are that manufacturers should advertise in the *Gardeners' Chronicle*, and the popular names are "time-wasting, trouble-giving, and truth concealing."

A LITTLE-USED BIBLIOGRAPHY.

It is unnecessary to call the attention of entomologists to the importance of such comprehensive bibliographies as the *Zoological Record*, the *Zoologischer Jahresbericht* and the *Berichte über die Leistungen auf dem Gebiet der Entomologie*. Every working entomologist who desires to keep abreast with the current literature must have them all or at least one of them. It is, however, not generally known that the German Botanical Record (*Botanischer Jahresbericht*) also contains an entomological chapter, viz, on insect injury to plants, including galls and plant deformations caused by insects. The literature on the latter subject is here more fully treated than in the Zoological Records, but largely from the botanical stand-point. The entomological editor is now the well-known Hymenopterist, Prof. K. W. von Dalla Torre, of Innsbruck, Austria.

NEW GENERA AND SPECIES OF PHYCITIDÆ.

At the meeting of the French Entomological Society, held January 8, 1890, Mons. E. Ragonot presented the descriptions of the following new genera and species of North American *Phycitidæ*: (*Ann. Soc. Ent. France* 1890, *Bull. des séances*, pp. vii-viii); *Ulophora* n. g., type; *U. grotei* n. sp. from North Carolina. (To this genus belongs *Myelois guarinella* Zeller from Columbia); *Glyptocera* n. g., type: *Ephestia consobrinella* Zeller; *Laodamia*, n. g., type: *Pempelia facella* Zeller; *Lætilia*, n. g., type: *Dakruma coccidivora* Comstock.

A SOCIAL PAPILIO LARVA.

None of our North American species of *Papilio* can be called social in the larva state, and even when they are abundant on one particular tree, *e. g.*, the larvæ of *P. cresphontes* on a young Orange tree or on a Prickly Ash, they are not social since it is evident that they do not care for the company of each other. It is rather strange, therefore, that in a species from Cuba (*Papilio oxynius* Hübn.), the larvæ should be social. Dr. P. Gundlach, the venerable explorer of the Cuban fauna, has already recorded this fact in his contributions to the Cuban Entomology, but he has corroborated his former observations by recent experience communicated in a letter to Mr. E. G. Honrath (*Berl. Ent. Zeits.*, v. 33, 1890, p. (8)). It appears that the larvæ of this *Papilio* feed at night on a species of *Xanthoxylum* (Prickly Ash), but during

the day they are found huddled close together on the lower part of the trunk in large companies, fifty-six specimens and more having been counted in a single flock, all with the heads turned in the same direction. Doctor Gundlach speaks only of the more mature larva and leaves us in doubt about the mode of oviposition and habits of the young larva. Pupation does not seem to take place on the trunk, for a large number of full-grown larvæ purposely left on the trunk of a particular tree were entirely lost sight of.

REMARKABLE CASE OF RETARDATION.

Dr. A. Speyer relates (Stett. Entom. Zeit., 1888, p. 205) that of two larvæ of *Bombyx (Gastropacha) lanestris*, collected in June, 1882, and which pupated shortly afterwards, the one did not produce the imago until April 4, 1887, after a pupal rest of five years. He now informs us (l. c., 1889, p. 140) that the other pupa produced the imago two years later, on April 9, 1889. It had thus been in the pupa stage seven years. In this particular species of Bombycids retardation in development has frequently been observed, specimens often remaining two years in the pupa stage, and Dr. Speyer had previously noted retardation of three and four years duration. The remarkable thing in these five and seven years' instances of retardation is that the imagos were not inferior in size to those hatched after a normal pupal rest of one year.

AN IMPORTANT WORK ON EUROPEAN GRAPE-INSECTS.

Professor Valéry Mayet's work, "Les Insectes de la Vigne" (Paris, 1890), to which has just been awarded the Dollfus prize by the French Entomological Society, forms a stately volume of 470 pages, with eighty-one figures in the text, and five plates (four of them colored), and is the most noteworthy recent publication in the domain of economic entomology. To the entomologist, as well as to the vineyardist, this work will for a long time remain a reliable source for the study of the economy of all insects injurious to the grape-vine.

The Grape Phylloxera naturally claims most attention of all grape-insects, nearly 120 pages or about one-fourth of the whole work being devoted to it, the bibliography alone occupying nearly 17 pages, and the chapter on remedies and modes of prevention (very fully illustrated) 50 pages. A full enumeration of the insects treated by Professor Mayet would occupy too much space, but would be of great interest if placed side by side with the insects injurious to the grape-vine in our own country. The insects infesting grape-vines in Europe are as follows, distributed among the various orders: *Diptera*, one species; *Homoptera*, thirteen species (three *Coccidæ*, two *Aphididæ*, one *Fulgoridæ*, four *Cicadidæ*); *Heteroptera*, six species; *Lepidoptera*, seventeen species (twenty-two species have been observed in fact but five have never proved to be injurious to any extent); *Neuroptera*, one species; *Ortho-*

ptera, six species; *Coleoptera*, forty species (out of a much larger number actually observed to feed on grape-vine); *Hymenoptera*, two species. In the Appendix are further mentioned: *Thysanura*, one species (hardly injurious), and *Thysanoptera*, two species.

DERMESTID BEETLES INFESTING MUSEUMS.

Trogoderma insulare Chevrolat, a Dermestid beetle originally described from Cuba, has lately been found by Mr. H. Lucas* at the Museum of the Jardin des Plantes at Paris, France, infesting insect collections received from Panama, the injury done by the larvæ being very serious. We presume Mr. Lucas has at once taken steps to exterminate this pest in his boxes, and that we are thus prevented from ascertaining whether or not this American insect would have become naturalized in Europe.

While it is true that by the general watchfulness on the part of the owners and keepers of collections the distribution of these museum pests is largely prevented, it must be remembered that these Dermestids are not only found in collections but also feed on the bodies of dead flies, spiders and other insects in the dark corners of our rooms, under furniture, etc., and that they should find, therefore, no difficulty in spreading from house to house, from city to city, and finally from one continent to another. But this is only correct regarding a portion of the species, *Dermestes lardarius* has, together with other species of the same genus, become cosmopolitan in distribution and the same may be said of *Anthrenus varius* and *Attagenus piceus*.† On the other hand, *Anthrenus scrophulariæ*, the best known museum pest in Europe, is entirely unknown in American collections of insects and other objects of natural history. It is well known that this species has been imported of late years into the northeastern part of the country where it is greatly injurious to carpets, but for some reason or another it seems to be unable to extend its range southwards and even makes slow or no progress westward. Our own most destructive museum pest, *Trogoderma tarsale*, has never established itself in Europe where it is replaced by *T. versicolor*.

The Chilian *Eurhopalus variegatus* has to our knowledge never been found elsewhere. In the *American Naturalist* (v. 16, 1882, p. 826) Professor Riley called attention to the fact that *Perimegatoma variegatum* infests insect collections in California, but in spite of the lively inter-

* *Annales Soc. Ent. France*, 1889, p. cxi; description of larva and pupa by the same author, l. c., p. ccx.

† This last named species is of late years decidedly increasing in numbers and destructive powers in Washington, D. C. The larvæ have repeatedly been found in insect boxes which were not quite tight, but fortunately they are larger and more cylindrical than those of *Anthrenus* or *Trogoderma* and unable, therefore, to enter the box through a very small crack. Moreover they feed only externally on insects and do not enter their bodies as is the custom with *Anthrenus* and *Trogoderma*. As a household pest they injure carpets in the same way as *Anthrenus scrophulariæ*.

course between the entomologists of the Pacific and Atlantic slopes it has never been found in the Eastern States.

From these facts it would seem that the apparent facilities for the spread of these Dermestids are counteracted, or at least greatly interfered with by the intricate natural laws which govern the distribution of animated beings.—E. A. S.

CERAMBYCID LARVÆ OCCASIONALLY BENEFICIAL.

Certain cerambycid larvæ (*Leptostylus* and *Hyperplatys*) have been observed by Mr. Schwarz (*Proc. Ent. Soc. of Washington*, v. 1, p. 165) to destroy the larvæ of Scolytid beetles by running their own galleries through the colonies of the Scolytids. A similar instance is recently reported by Professor Altum, of the Forestry Academy at Eberswalde, Germany (*Zeitschrift für Forst- und Jagdwesen*, v. 22, 1890, p. 55). In consequence of the favorable weather of 1889 the larvæ of *Lamia* (*Acanthocinus*) *ædilis* were very common and worked so vigorously under the bark of felled pine trees that they crowded out and killed the half-grown larvæ of a Scolytid, *Hylesinus ligniperda*, which infested the same logs.

DIMORPHIC FEMALES OF BUTTERFLIES.

It is a well known fact that in certain Diurnal Lepidoptera the male sex is constant in coloration while the female appears in two forms, one being similar in coloration to the male, the other considerably different therefrom. An instance of this class is our *Papilioturnus*. In other cases of female dimorphism the form resembling the male is wanting, as is the case in our *Argynnis diana*. Mr. Charles Oberthür now advances the question (*Ann. Soc. Ent. France*, 1889, *Bull.*, p. CCXXXV) whether in this latter case the form corresponding in coloration with the male should not always exist. He believes that in these polymorphic species the original form of female was of the same coloration as the male, and the aberrant form developed subsequently and gradually. As a proof of this hypothesis he communicates an interesting recent discovery. *Argynnis niphe* is an old and common species enjoying a remarkably extended range, since it occurs in Abyssinia, India, China, on the Philippine Islands, and Java. From all these widely distant localities the female of this species was hitherto known only in a form strikingly different from the male. Quite recently, however, Mr. Oberthür received from a place in southern Hindoostan bearing the attractive name of Trichinopolis, specimens which prove that in this particular locality the female of *A. niphe* differs no more from the male than in most other species of *Argynnis*. Does Mr. Oberthür's hypothesis hold true in all cases, and should we really expect to find in our *A. diana* females which correspond in coloration with the male?

AN IMPROVED INSECT LIME.

Quite a large number of periodicals are devoted in Germany to the various branches of scientific forest culture and contain not infre-

quently entomological articles of considerable economic interest written by competent authorities and observers. Since these periodicals are but little read in this country our entomologists know of the existence of these articles only when they are collated in general and more accessible works on forestry insects, *e. g.*, the well-known works by Ratzeburg, Altum, Eichhoff, Judeich and Nitzsche, etc. Through the kindness of Prof. B. E. Fernow, chief of the forestry division of the U. S. Department of Agriculture, we have before us the more recent numbers of one of these periodicals, the *Zeitschrift für Forst- und Jagdwesen* (Berlin, Julius Springer) for 1889 and 1890,* from which the following note is taken:

In comparison with the tar rings employed here to prevent injurious caterpillars from ascending trees, the rings of adhesive lime, of late years largely used by the German foresters, appear to be greatly superior in every respect. The lime is manufactured by two firms, L. Pohlborn, Berlin, and Schindler & Mitzell, Stettin, both kinds appearing to be of the same quality. We are not told of what material this lime is made, but it probably largely consists of boiled linseed-oil (birds' lime.) It is not in the least injurious to the trees and its superiority over tar becomes at once apparent from its long effectiveness, since rings applied in early spring retain their adhesive power till late in the fall. The lime as now used is of the consistency of green soap, so that it has to be smeared on and can not well be painted on the trees. To facilitate this operation a simple wooden implement consisting of two pieces is used; a saving of material is thereby effected, and the rings can be made of even width and thickness. The cost of this lime is, in Germany, \$4.25 per hundred kilograms (50 pounds), including freight to some distance. In an experiment on a large scale made in 1888, rings 30 milli-

* The following is a list of the entomological papers in the volumes for 1889 and 1890 (so far as published) of this periodical, the translations of the titles not being verbatim:

Contributions to the life history of and the mode of warfare against *Bombyx pini*. By Professor Altum, 1889, pp. 39-47.

The destruction of *Orgyia pudibunda*. By Professor Altum, 1889, pp. 166-169.

Contributions to the life history of certain species of *Lyda* (*Tenthredinidae*). By Dr. Karl Eckstein, 1889, pp. 210-218.

Experimental application of lime rings for preventing injury by *Orgyia pudibunda*. By W. Boden, 1889, pp. 219-222.

Tenthredo cingulate Fabr., a "deceptive" Saw-fly. By Professor Altum, 1889, pp. 271-274.

Grapholitha strobilella L. By H. Gerike, 1889, pp. 321-326.

The banded Pine Geometrid (*Ellopija fasciaria* L.) By Professor Altum, 1889, pp. 403-408.

The Winter Geometrids. By Professor Altum, 1889, pp. 641-647.

The mode of feeding in the Pine Bombyx, the Pine Noctua, and the Pine Saw-flies. By Professor Altum, 1890, pp. 81-82.

The new Pine Geometrid (*Ellopija prosapiaria* L.) By Borgmann, 1890, pp. 141-145.

The Basket-Willow Leaf-beetle (*Chrysomela vulgarissima*). By Dr. Karl Eckstein, 1890, pp. 145-148.

meters in width and 4 millimeters in thickness were applied to 885 trees of an average diameter of 18 centimeters, at a total cost of 27.40 marks (about \$6.80) including labor. The rings were smeared around the trunks at a height of $1\frac{1}{2}$ meters from the ground; if laid much higher up so as to necessitate the use of ladders the cost of labor was correspondingly increased. As stated above, the rings have in all cases proved to be a perfect protection against all caterpillars that attempted to ascend the trees during the whole season.—E. A. S.

UTILIZATION OF THE STING OF THE HONEY-BEE IN THERAPEUTICS.

This old and half-forgotten subject has been brought up again recently by Dr. Al. Laboulbène at the meeting of the French Entomological Society, held on March 13, 1889. Dr. Laboulbène gave then a short abstract of a paper published in 1888 by an Austrian physician, Dr. Terc, who seems to have made extended experiments for a number of years. Dr. Terc asserts that a person stung by bees acquires thereby a relative immunity for the consequences of subsequent stings; in other words, that the virus of the bee sting acts like a vaccinal inoculation against its own poison. The immunity lasts six months, sometimes less, probably according to the number of stings inflicted on a person. Persons suffering from acute rheumatism require a larger number of bee-stings to feel the usual effect of the poison, but as soon as by inoculation of a sufficient amount of virus they have acquired immunity against its effect, they will—as long as this immunity lasts—be free from rheumatic attacks. Dr. Laboulbène suggests that, in the interest of medical science, it would be well to thoroughly test these assertions.

ON OTIORHYNCHIDÆ.

In the *American Naturalist*, v. 16, 1882, pp. 915, 916, Dr. Riley gave a list of the North American weevils of the family *Otiornychidæ* which are injurious to cultivated plants, adding thereto an enumeration of those species of which the food-habits were recorded. To these may now be added *Aramigus tessellatus*, which, according to E. A. Popenoe (*Industrialist*, May 29, 1886), infests the Sweet Potato in the West; *Scythropus elegans*, which is enumerated by Mr. W. H. Harrington (*Trans. Ottawa Field Nat. Club*, v. 2, 1881, p. 33) among the enemies of pine trees in Canada; and *Graphorhinus vadosus*, the imago of which feeds on the leaves of clover, according to F. M. Webster (*Amer. Nat.*, v. 16, 1882, p. 746). Of late yeavs three additional species have been recorded as injurious to cultivated plants. *Otiornychus ovatus*, which proved to be a not insignificant enemy to the strawberry, as first pointed out by Prof. A. J. Cook, who also described its earlier stages; *Aragnomus griseus*, which was recorded by Dr. Riley (*INSECT LIFE*, v. 1, 1888, p. 16) as an enemy to pear trees in Oregon. The third species is *Otiornychus sulcatus*, which occurs in both North America and Europe, and which, in the latter country, has been quite

frequently mentioned and treated of as an enemy to grape vines, strawberries, and other cultivated plants. In North America, Dr. J. A. Liutner (*Second New York Report*, 1885, p. 51) introduced it, on the testimony of Mr. S. Henshaw, as a species injurious to "bulbs and house-plants," Mr. Henshaw's statement apparently referring to injury done in Massachusetts. Quite recently Dr. H. A. Hagen (*Psyche*, v. 5, No. 167-'8, March-April, 1890, p. 333) states that this species has injured Cyclamens in greenhouses at Montvale, Mass., the flowers being destroyed and in some instances the bulbs injured. It is not stated whether the latter kind of injury is done by the imago or the larva. In reviewing the history of the species in North America, Dr. Hagen says that "Professor Riley, in his third Missouri report (1871, p. 11), states that the species infests the crown of strawberries, but does not say where it was observed." If Dr. Hagen would carefully read the whole paragraph from which the above passage is quoted he will find that Professor Riley distinctly referred to injury done by weevils in Europe, instancing a number of European species, and among them this *Otiorhynchus sulcatus*.

As to the probable future course of this pest we do not anticipate that its injury will be a very serious one nor that it will spread very much. The species was already known from North America to coleopterists more than sixty years ago and is confined to the extreme northeastern portion of the country (from New York northward to Newfoundland and Nova Scotia). For this reason we are inclined to believe that it is not an imported species but that it belongs (with the other species of *Otiorhynchus* known from North America) to the circumpolar fauna. It is a peculiarity of the circumpolar insects that, with few exceptions, they do not seem capable of extending their range southward, at least not at a rapid rate, and they seem further incapable of doing very serious injury. The only notable exceptions that occur to us are *Agrotis fennica* and *Otiorhynchus ovatus*. But either species has not spread over a large stretch of the country. These circumpolar species thus form a most striking contrast to the introduced and cosmopolitan insects and to some extent also to those insect pests which, originally belonging to the Central or South American faunas have advanced from the south, *e. g.*, the Cotton Worm, the Chinch Bug, the Harlequin Cabbage Bug, etc.—E. A. S.

A CHEAP SPRAYING APPARATUS.

Our attention is called by the *Southern Horticultural Journal* of May 15 to a cheap spraying apparatus described and figured by Prof. Roland Thaxter in Bulletin No. 2 of the Connecticut Experiment Station. It may be constructed by any ingenious person and is designed to take the place, especially in vineyard work, of the more expensive knapsack "Eureka" sprayer manufactured by Adam Weaber & Son, of Vineland, N. J.

The apparatus (Fig. 3) consists of a reservoir, pump and nozzle. The

reservoir is an ordinary copper wash-boiler of small size. The pump is of the "hydronette" or "aquanette" pattern, and is connected with the boiler by means of a hose which enters at *e*, and passes to the bottom of the boiler. The boiler is fitted with straps as in the case of the ordinary knapsack sprayers.

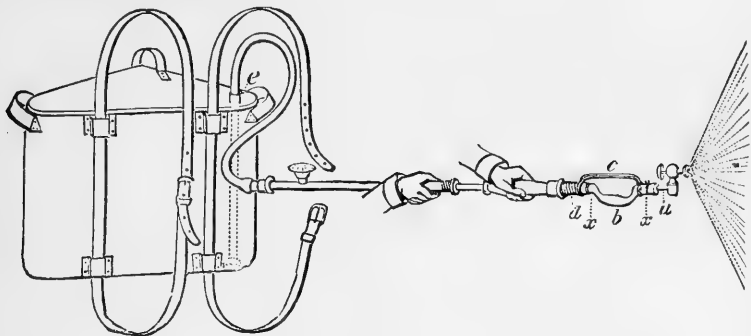


FIG. 3.—Spraying apparatus designed by Dr. Roland Thaxter. (After Thaxter.)

The Vermorel nozzle is used, and in order to give continuous action to the spray, which would not be accomplished with the single-acting pump used, a sort of compression chamber is contrived between the pump and nozzle as follows: A piece of $\frac{5}{8}$ -inch elastic tubing *b* (hose will not answer) is fastened to the nozzle and pump at *x. x*. The nozzle and pump are also connected with two heavy copper wires *c*, which support the elastic tube *b*, and may be bent to give the nozzle any desired direction. The expansion of the tube *b* is sufficient with the Vermorel nozzle to produce a continuous spray. For limited operations, we have no doubt, this apparatus will prove satisfactory; its cost should not exceed \$12, of which amount the pump would represent about \$8.—C. L. M.

A PAPER ON MYIASIS.

The subject of Myiasis or the Pseudo-parasitism of Diptera in Man is quite fully treated in a paper by Hugo Summa, A. M., M. D., professor of Physiology, Histology, and Pathology in the St. Louis College of Physicians and Surgeons. The three articles comprising this paper originally appeared in the April, May, and June, 1889, numbers of the *St. Louis Medical and Surgical Journal*. Article I sums up all the hitherto recorded cases of Dipterous larvæ infesting the human body which could be found and consulted. Article II divides the subject into two parts (myiasis of wounds, nose, ears, and eyes, caused by *Sarcophagidæ* and *Muscidæ*; and myiasis of the intestines caused by *Anthomyidæ*), cites a few recorded cases omitted in the first article, and describes in detail two new recent cases of nasal myiasis, one observed by the writer's brother, Dr. Henry Summa, the other by himself. The first of these was caused by the larvæ of *Calliphora (Musca) vomitoria*, the blue-bottle fly, and was cured in eight days by a nasal irrigation with

a $\frac{1}{20000}$ solution of corrosive sublimate used twice daily for five days, and doses of albuminous water and raw eggs on the stomach to counteract any injurious results from mercurial salivation. One of these living maggots was fed on raw beef and became a pupa, five days later developing into the perfect fly, original natural size figures being given of this pupa and fly. The other case, observed by the writer himself, was caused by the larvæ of *Sarcophaga carnaria*, the common flesh-fly, and though a very bad case was overcome in a few weeks; by what treatment is not stated. Injections of a five per cent solution of carbolic acid had been of no avail. Three original figures of one of these larvæ are given showing respectively the magnified larvæ and its anal and capital segments still more enlarged.

Article III considers the clinical history of myiasis, dividing it into (1) myiasis of wounds, (2) myiasis of nose, ears, eyes, and vagina, and (3) myiasis of the intestines. The first two are caused by *Sarcophagidæ* and *Muscidæ* being attracted to putrid or septic wounds, or to an offensive or purulent discharge from the various orifices of the body and depositing their eggs or larvæ therein. Such cases, after removing all the larvæ possible by mechanical means, are best treated with the corrosive sublimate injection (except in wounds), injections of chloroform diluted with sweet milk, or injections of citric acid or lemon juice. The insufflation of iodoform has also proved satisfactory in several cases. The last division of the subject, myiasis of the intestines, is caused by the *Anthomyidæ* depositing their eggs in spoiled vegetables which are afterward eaten in a raw state, as in salads. The same treatment should be used in this case as in helminthiasis.—C. H. T. T.

CODLING MOTH REMEDIES.

D. B. Wier, in the *Orchard and Farm* for May 15, after referring to the successful spraying with London purple for the Codling Moth, reported by Prof. M. H. Beckwith, of the Delaware Agricultural College, and of the similar favorable reports from other Agricultural Colleges and Experiment Stations, expresses the belief that this pest of the Apple and Pear, and also the Curculio of the Plum and Peach can by this means be effectually controlled. He gives, also, a mode of destroying the Codling Moth, which he claims to be of great value where the apples are carried to a shed or barn to be assorted and packed. He proposes to kill the myriads of worms which leave the apples while in such places to spin up in crevices of the building by fumigating with some gas, such as sulphide of carbon, fumes of burning sulphur, or the hydrocyanic acid gas used against the Cottony Cushion Scale. By making the apple shed or house of rough lumber, with plenty of crevices for the worms to spin up in and yet as near airtight as possible, it will be feasible, he says, to shut up and thoroughly fumigate in March, destroying the insects; or in smooth-plastered houses, traps of old boards and shingles, rags, etc., could be arranged,

which in February or March could be taken out and burned. Where the buildings could be kept closed during the early summer the hatching moths would eventually die, thus avoiding the necessity of fumigating. These remedies will doubtless be of value where apples are treated as indicated, the last two being mere variations of older suggestions.

THE ENTOMOLOGICAL SOCIETY OF WASHINGTON.

June 5, 1890.—Mr. Ashmead, under general notes, announced the discovery of a genus of Proctotrupidae new to the United States. The insect *Iphitrachelus americanus* is interesting as furnishing a connecting form between the subfamilies Cera-
phroninae and Platygasterinae.

Mr. Schwarz exhibited a specimen of *Throscus pugnax*, which species is new to the fauna of the District.

Professor Riley presented a paper "On the Difficulty of Dealing with *Lachnosterna*," in which he described the attacks of these beetles on certain large trees, especially a Chestnut and a Swamp Oak having a height of about 30 feet, which had been transplanted to his grounds last February. The successive appearance and work of several species of *Lachnosterna* were described and the experiments with remedies detailed. The latter consisted in spraying with a stroug whale-oil and tobacco-soap solution, and later with London Purple at the rate of 1 pound to 125 gallons of water.

The applications were satisfactorily made, but proved ineffective. The first did not prevent the attacks of the beetles at all, and while the second resulted in the poisoning of many of the beetles, as indicated by the finding of dead ones on the ground, it was of little value in limiting the onslaught. Professor Riley deduced from his experiments that it was practically impossible to protect large trees from *Lachnosterna*. It was shown also that the beetles came from the ground near the trees. The injury consisted in the gnawing off of the leaves at the base of the petiole.

The paper was discussed by Messrs. Fernow, Riley, Schwarz, Howard and Mann. In a paper entitled "Notes on *Xyleborus*" Mr. Schwarz commented upon the discovery of a wild food-plant of *Xyleborus dispar* (*pyri*). This Scolytid had been found quite recently in the vicinity boring and ovipositing in young shoots of *Liriodendron tulipifera*. In the same branches another species, *X. tachygraphus*, was discovered, and Mr. Schwarz exhibited and described its galleries.

Discussion followed by Messrs. Riley, Schwarz, Ashmead, and Fernow.

Mr. Howard read a paper entitled "The habits of *Eurytoma*," in which he called attention to the fact that heretofore the generally-surmised parasitic habit of the members of this genus had never been conclusively shown; and the close relationship of *Eurytoma* with the phytophagic genus *Isosoma* would lead to the inference that the former might be, in part at least, inquilines and not true parasites.

The following of a certain species from the larval stage to the pupal, in which they were at once recognized as a species of *Eurytoma*,* settled in one instance at least the question of larval habit. An Oak gall, *Cynips quercus-prunus*, was found, on cutting it open May 17, to contain six full-grown parasitic larvæ, afterwards determined as given above, and the remains of a larva which they had nearly devoured.

The paper was discussed by Messrs. Riley, Howard, and Ashmead.

C. L. MARLATT,
Recording Secretary.

* The imagos obtained later proved to be *Eurytoma prunicola* Walsh.

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DIVISION OF ENTOMOLOGY.

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JULY, 1889, to JUNE, 1890.

INSECT LIFE.

DEVOTED TO THE ECONOMY AND LIFE-HABITS OF INSECTS,
ESPECIALLY IN THEIR RELATIONS TO AGRICULTURE.

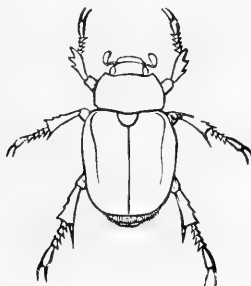
EDITED BY

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WITH THE ASSISTANCE OF OTHER MEMBERS OF THE DIVISIONAL FORCE.



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PERSONNEL OF THOSE ENGAGED IN GOVERNMENT ENTOMOLOGICAL
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ERRATA.

- Page 21, line 18 from bottom, read *Phylethus* for *Philetus*.
Page 26, line 23 from bottom, read 1859 for 18 9.
Page 47, line 9 from bottom, insert a colon after these.
Page 52, line 25 from bottom, read Hagen for Hagan.
Page 53, line 17 from bottom, omit of.
Page 55, line 11 from top, add (*Pseudopulvinaria*), after genus.
Page 55, line 12 from top, read *incana* for *incarna*.
Page 55, line 12 from top, read *Castanea indica* for *Castania india*.
Page 57, line 18 from top, read The Coccinellid beetles for These beetles.
Page 57, line 14 from bottom, read Trichopterygid beetles for Caddis flies.
Page 58, line 8 from top, read *Ptiliolum* for *Pteliolum*.
Page 66, line 14 from top, read *Melanoplus* for *Melanopus*.
Page 68, line 21 from top, read *Sarcophaga* for *Sarcophoga*.
Page 70, line 13 from top, read *Vedalia* for *Vedolia*.
Page 71, line 16 from top, read *Vedalia* for *Vedolia*.
Page 73, in explanation of figure, read *Vedalia* for *Vedolia*.
Page 78, line 10 from bottom, read Nuttall for Nuttal.
Page 83, line 3 from bottom, read *nigripectus* for *nigrifectus*.
Page 90, line 8 from top, read Camellias for Camelias.
Page 90, line 8 from top, read *filifera* for *fillifera*.
Page 91, lines 14 and 8 from bottom, read *Cryptochatum* for *Cryptochatum*.
Page 92, line 17 from top, read Division for vision.
Page 101, line 11 from bottom, read genal for genial.
Page 101, line 11 from bottom, read foveæ for foviæ.
Page 102, line 22 from bottom, read flies for fles.
Page 108, line 1 from top, read *herculaneus* for *herculeanus*.
Page 108, line 16 from top, read main source for mains ource.
Page 112, line 15 from top, read *Rhyssematus* for *Ryssematus*.
Page 112, line 18 from bottom, read *Vedalia* for *Vedolia*.
Page 116, line 5 from bottom, read fasciæ for fascia.
Page 117, line 19 from top, read belongs for belong.
Page 119, line 19 from top read *Amphicarpæa* for *Amphicarpæa*.
Page 120, center column, line 20 from top, read *Coryliella* for *Caryliella*.
Page 123, line 6 from bottom, read *sericeum* for *sericorne*.
Page 126, line 1 from top, read Entomophthora for Entomophthora.
Page 126, line 9 from top, read Entomophthora for Entomophthora.
Page 127, line 7 from top, read Entomophthora for Entomophthora.
Page 127, explanation of figure 19, *b*, read pupa within larval skin. for larva, ventral view.
Page 128, line 17 from top, omit "and *b* from below."
Page 128, line 20 from bottom, add after "larva," as shown at *b*.
Page 132, line 13 from bottom, read *Phragmites* for *Phragmites*.
Page 138, line 9 from bottom, read Fig. 22 *p.* for Fig 22 *r.*
Page 147, line 23 from bottom, read "Sattelmücke" for "Sattlemarke."
Page 151, line 18 from bottom, read clear for clean.
Page 154, line 1 from bottom, read *Gelechia* for *Galechia*.

- Page 155, line 5 from top, add Chambers after IDE.
- Page 167, line 4 from top, read *Ephestia* for *Ephstea*.
- Page 182, line 12 from top, read they can not be recommended, for they can be recommended.
- Page 192, line 15 from bottom, read elliptical for ellipticle.
- Page 193, line 15 from bottom, read The Five-ribbed Tea-mite for Five-legged Tea-mite.
- Page 193, line 21 from bottom, read *bioculatus* for *biaculatus*.
- Page 195, line 1 from top, read hymenopteron for hymenopterian.
- Page 209, line 4 from bottom, read Azalea for Azalia.
- Page 211, line 11 from top, read 5 for 13.
- Page 211, line 12 from top, read 8, 9, and 10, for 14, 15, and 16.
- Page 226, explanation of figure, read from for rfom.
- Page 253, line 18 from bottom, read naphtha for napytha.
- Page 259, line 16 from bottom, read springtails for neuropters.
- Page 259, line 13 from bottom, read *rubigo-vera* for *rubigovera*.
- Page 261, line 10 from bottom, read *ludens* for *lugens*.
- Page 264, line 6 from top, read "Fangpflanzen" for "Fangenpflanzen."
- Page 271, line 17 from bottom, omit comma after infests.
- Page 272, line 4 from bottom, read *rosæ* for *roseæ*.
- Page 277, line 12 from top, read fuchsias for fuschias.
- Page 280, line 20 from top, read Borkenk. for Borkask.
- Page 280, line 16 from bottom, read *scutellaris* for *scutellatus*.
- Page 280, line 4 from bottom, read *Gortyna* for *Gortina*.
- Page 283, line 1 from top, add of 18-9, after Season.
- Page 283, line 12 from bottom, read *Eudiopsis* for *Endiopsis*.
- Page 283, line 9 from bottom, read Treitschke for Treitschke.
- Page 283, line 6 from bottom, read *malefida* for *malepida*.
- Page 302, line 17 from top, insert palpi after labial.
- Page 303, line 5 from top, read longius for longuis.
- Page 312, line 19 from top, read welfare for wefare.
- Page 313, line 7 from top, read parasitic for parisitic.
- Page 322, line 7 from top, insert Type before TISCHERIA.
- Page 323, line 23 from bottom, read grateful for greatful
- Page 328, line 15 from bottom, read *pastinacæ* for *pastinacæ*.
- Page 329, line 3 from bottom, read Chrysopas for Chrysopus.
- Page 330, line 8 from bottom, read *Gracilaria* for *Gracillaria*.
- Page 360, line 3 from top, read Rhinebeck for Buffalo.
- Page 366, line 5 from top, read 70 for 60.
- Page 371, line 13 from bottom, read 31 for 21.
- Page 379, line 11 from top, transpose first the to beginning of line.
- Page 383, line 11 from bottom, read *Lithophane* for *Lithophana*.
- Page 390, line 5 from top, omit probably.

SPECIAL NOTES.

Insects injuring Cotton in Egypt.—One of the last official acts performed by the late Hon. Eugene Schuyler, United States agent and consul-general at Cairo, before his recent untimely and lamented death, was to send us a copy of Albert Ismalun's brochure upon the cotton insects of Egypt and (through the State Department and the honorable Secretary of Agriculture) a dispatch containing a translation of a recently published article on the same subject by Dr. E. Sickenberger of the Cairo Medical School. We print this dispatch in the "extracts from correspondence" of this number as a matter of entomological interest, although there is little danger, as Mr. Schuyler feared, of the importation of any of these pests into this country, and certainly none that "the cotton exported from Egypt to the United States might contain the eggs." Of the three species treated, the *Prodenia* seems to be isotypical with the *Laphygma frugiperda* of our Southern cotton fields, and the *Oxycarenus* with our *Dysdercus suturellus*.

A Japanese Parasite of the Gypsy Moth.—Rev. H. Loomis, of Yokohama, has just written us the following interesting letter :

I have seen the reports of the ravages of the *Oeneria dispar* at Medford, in Massachusetts, and have taken considerable interest in the matter.

Some time last season the same caterpillar appeared on a wistaria vine near my house and was very destructive, but after a while the caterpillars began to die and I discovered that an ichneumon fly had attacked them with great success.

This spring the caterpillars have been very few, and in nearly every case have been destroyed by the ichneumon flies.

I will send you a box in which are some of the cocoons of the ichneumon fly, and also two specimens of their work. Perhaps this may be of some value to those who are interested in the extermination of the pest.

This matter is one of great interest for the reason that no parasites have as yet been found to attack the Gypsy Moth in this country. We stated in our article on page 210 of Vol. II that we thought it very

probable that some of our native species would acquire a taste for this pest, and this species, which Mr. Loomis sends, is confirmatory of our surmise. The *Ocneria* has evidently been imported into Japan from Europe and as the parasite which he sends can not be identified with any of the known European parasites it is probably a Japanese insect which has learned to prey upon the *Ocneria*. The parasite is an *Apan-telea* and seems to be a new species. The Microgasters, by the way, seem very fond of this larva as our list in the article above referred to embraces no less than nine species which prey upon it in Europe.

The Oviposition of the Horn Fly.—In regard to the egg-laying by the Horn Fly, Prof. J. B. Smith (in his annual report for 1889) takes direct issue with us upon the point as to whether the eggs are laid during the day or during the night, a point of considerable practical importance in view of its bearing upon remedies.

We have carefully searched through Professor Smith's account, and the only definite observation which he has recorded is that flies put in a large bottle with fresh cow-dung rested quietly upon the glass and upon some chips which he had also placed in the bottle and had not oviposited "early that evening; *i. e.*, 8 o'clock. Next morning the flies were still alive, and there were numerous eggs on the chips, on the sides of the bottle, and on the top of the manure." He also quotes Mr. Bodee, of Freehold, to the effect that the eggs are laid at night, and in fresh droppings. On the strength of these premises, and ignoring the fact that cows normally drop no dung from the time when they lie down at night until they arise at daylight, Professor Smith disputes the force of the positive observations detailed in our article on pp. 93-103 of Vol. II.

These observations by Mr. Marlatt, as there stated, were made in the field upon the *natural* process of oviposition. From these observations, repeated a number of times, and from the long course of field study, both by Mr. Marlatt and Mr. Howard, there can be no doubt but that the eggs are normally laid only at the moment of the dropping of the dung. Mr. Marlatt's observation that the number of eggs laid in dung dropped between sunrise and 7 o'clock compares with those laid in the hot sunshine between 10 and 11.30 only in the proportion of 10 to 350 is conclusive against Professor Smith's position. We consider that our generalization to the effect that "the eggs are deposited during daylight, chiefly during the warmer time of the day, between 9 and 4, and mainly between 9 in the morning and noon," is more than substantiated by recorded observations and is not vitiated in the least by the action of frightened flies confined in a bottle, and which from Professor Smith's own statement (and from our own experience frequently repeated) departed so far from their normal habit under these unusual conditions as to oviposit upon chips and glass. The statement, however positive, of

Mr. Bodee, unsubstantiated and unaccompanied by any particulars, in a matter where error is so easy, is of little value against these positive facts.

Sending Codling Moth Enemies from the United States to New Zealand.—Sometime since we instructed our California agent, Mr. Koebele, to collect and forward a number of living specimens of a common *Raphidia* which he had found to destroy the larva and pupa of the Codling Moth in California, to Mr. Wight in New Zealand, as a partial return for Mr. Wight's kindness to Mr. Koebele when he was in New Zealand in the spring of 1889 collecting the insect enemies of the Fluted Scale. Recent letters from Mr. Wight and an article in the June number of the *New Zealand Farmer*, inform us that the shipment arrived in fairly good condition, although it was opened for examination and held for ten days at the custom-house. Twenty-one specimens were sent, each one in a small box with moss, and the whole inclosed in a strong wooden box. Mr. Wight found pupæ in sixteen of the boxes and a larva in one, while three were empty, probably owing to the custom-house examination. The single larva was hungry and very attenuated and it at once attacked and devoured a Codling Moth larva twice its own size. It was so stretched out and distended that at first, not discovering the absence of the Codling Moth larva, Mr. Wight thought it was entering the pupa state; but it presently resumed its usual appearance and finished several more larvæ.

We shall look forward to the result of this importation with great interest. The genus *Raphidia* is represented in this country only upon the Pacific coast and it is not at all likely that it will flourish East. We shall attempt, however, the introduction of this ravenous creature into some of our eastern apple orchards.

Economic Entomology in India.—No. 4.—Through the kindness of Mr. E. T. Atkinson and Mr. E. C. Cotes, we have lately received No. 4 of Vol. I of the interesting "Indian Museum Notes" to which we have before referred in these pages. The present number contains pages 175 to 213, illustrated by a single well-executed plate from the drawings of Mr. G. C. Chuckerabotty, a native artist of considerable ability. The articles in this number comprise "Notes on Rhynchota," by Mr. E. T. Atkinson; "New Species of Indian Diptera," by Mr. J. M. F. Bigot; "A Butterfly Destructive to Fruit," by Mr. L. de Niceville, and "Miscellaneous Notes," by Mr. E. C. Cotes.

Mr. Atkinson's article is devoted principally to the consideration of the so-called "mosquito-blight" which we have referred to in the review of one of Mr. Green's articles upon the insects injurious to the tea-plant in Ceylon. Mr. Atkinson describes several species of Heteroptera of

the family *Capsidæ* and of the genus *Helopeltis* which are concerned in the damage to tea and other plants, known as "mosquito-blight," and after a consideration of the remedies at present in use he urges the adoption of our kerosene-soap emulsion as the best remedy which he can suggest. Mr. Atkinson also records the finding of a Wax-scale (genus *Ceroplastes*) on the tea plant and suggests that the waxy portion of the adult female may possibly be used as an article of trade like the insect-wax of the *pela* in China. The species has been sent to Mr. Maskell, of New Zealand, for determination. The butterfly which Mr. de Niceville treats of as destructive to fruit is *Virachola isocrates*, Fabr. This insect damages the fruit of the Locust, Guava, and Pomegranate, by laying its eggs within the calyx of the flower, the larva boring into the young fruit within which it develops and transforms. No remedy is suggested beyond catching the female butterfly, but the arsenical sprays would doubtless serve to prevent the injury.

Mr. Cotes, under the head of "Miscellaneous Notes," treats of a number of interesting matters which we have not the space to mention in detail.

Bean Insects in Nebraska.—In the report of the Horticultural Department, extracted from the second annual report of the experiment station of the Kansas State Agricultural College for the year 1889, Prof. E. A. Popenoe takes up the subject of some insects injurious to the Bean. The principal article under this head is, naturally, the Bean-weevil (*Bruchus obsoletus* Say). After practical tests, Professor Popenoe indorses the use of bisulphide of carbon as a remedy, following the recommendations of the Entomologist of this Department. The other insects considered are the Bean Leaf beetle (*Ceratoma caminea* Fabr.), and two plant-bugs, viz, *Agalliastes bractatus* Say and *Halticus minutus* Uhler, MS. These insects injure the Bean by feeding in great numbers on the under side of the leaves, puncturing the tissues, sucking the sap, and causing the death of the leaves in small irregular patches that appear as white spots. They operate mostly near the ground and upon weak, slow-growing varieties, and sometimes do appreciable injury to the plant. No practical conclusions have been reached regarding these last two insects.

Common native Insects of South Australia.—We have just received from the author, Mr. J. G. O. Tepper, F. L. S., Part II of his treatise upon the common insects of South Australia.

This part is devoted to the Lepidoptera, or butterflies and moths, and has just been printed at Adelaide.

THE CLOVER MITE.

(*Bryobia pratensis* Garman.)

By C. V. RILEY and C. L. MARLATT.

The subject of this article has been referred to several times in INSECT LIFE in extracts from correspondence, notes, and otherwise, but no full account of it has been given. Occasion is now taken to place on record the notes accumulated by the Division relating to its distribution and habits together with such recommendations as to remedies as past experience warrants. *Bryobia pratensis* belongs to the family of vegetable-feeding mites, Tetranychidæ, which includes the well-known Red Spider of hot-houses and the Six spotted Mite of the Orange, which was described and figured in the annual report of the Entomologist for 1889. It occurs very commonly in the Northern and Central States from Massachusetts to California, and is especially annoying on account of its habit, frequently developed in spring and autumn, of migrating in enormous numbers into houses. No specimens have been received from the Southern States, but the fact that it is abundant about Washington would lead us to expect its occurrence farther south.

The wide distribution of the species might lead to the supposition that there were several distinct species; but a careful examination of the large series of specimens in the national collection shows no other differences than in size and coloration, such as may be found in specimens on a single piece of bark or leaf and which are chiefly due to varying degrees of maturity.

This *Bryobia*, from a general resemblance in habit, shape, and color (particularly in its younger stages) to the Red Spider of hot-houses, was at first confounded with the latter species, which also, as is well known, occurs not infrequently on trees and plants out of doors. In our earlier notes we referred to it, therefore, as the red spider (*Tetranychus telarius*); and, in the published writings of others concerning the occurrence of this last species out of doors, both mites have doubtless been, in like manner, confused.

This mite was first characterized scientifically in 1885 by Mr. H. Garman in Forbes's Third Report, pages 73, 74, under the name given above, which description is given at the close of this article. The species described in the same place by Mr. Garman as *B. pallida* is evidently but an immature form of *B. pratensis*. Concerning this *Bryobia* Professor Forbes reported the following :

At Normal, early in May, the general occurrence of a large and conspicuously brownish-red mite was noticed upon clover and blue-grass, the former of these plants, especially, sometimes suffering severely from the pest. The leaves of the clover turned yellow, and their growth was arrested where the mite was abundant. The effect on the blue-grass was similar.

In an article by Mr. Garman, on "Injuries by Plant Mites," read before the meeting of the Central Illinois Horticultural Society and published in the *Prairie Farmer* of June 26, 1886, the observations in Forbes's report were repeated and the further statement was made that still another Bryobia damages the plum trees in the Pacific coast region. We have not, however, as already intimated, been able to find any characters to separate the mites obtained from California, Oregon, and Montana from those received from Central and Eastern States.

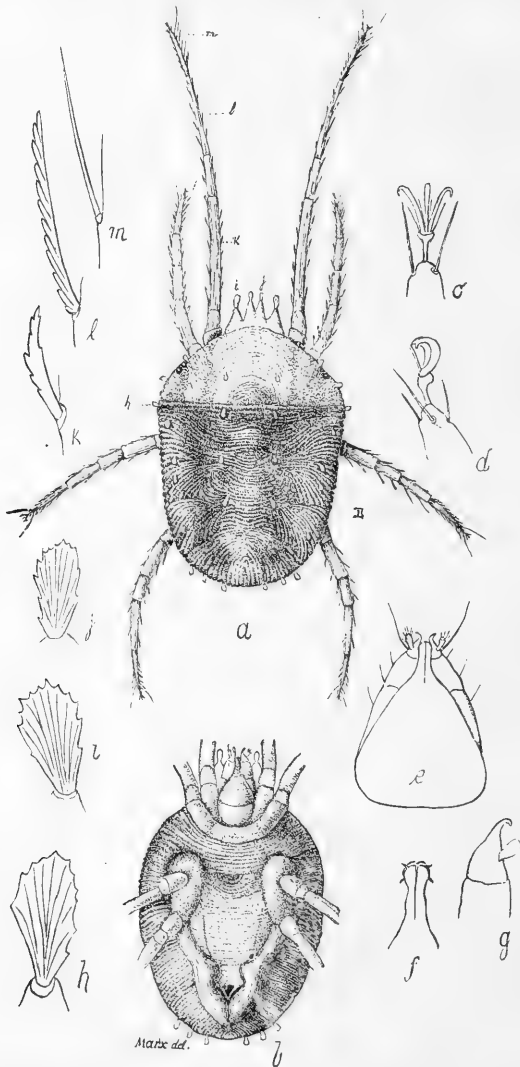


FIG. 4.—*BRYOBIA PRATENSIS*: *a*, Female from above; *b*, do. ventral view, with legs removed; *c* and *d*, tarsal claws; *e*, proboscis and palpi from below; *f*, proboscis enlarged; *g*, palpus enlarged; *h*, one of the body scales; *i*, scale from outer cephalo-thoracic prominence; *j*, scale from inner cephalo-thoracic prominence; *k*, serrate hair from basal joint of leg; *l*, same from penultimate joint; *m*, spine of last joint; *a*, *b*, greatly enlarged; *c*–*m*, still more enlarged (original).

In the following brief review of our notes and observations relating to this mite we have preferred to associate by localities all references to it, rather than to adopt a chronological arrangement. From these notes a good knowledge of its distribution and habits may be obtained, the entomologist having personally observed it not only at Washington but at many points in the Mississippi Valley, as far as St. Louis, where it is quite common, and also in California.

Distribution.—The first reference to the occurrence of this mite at Washington bears date of March 21, 1879, when the eggs and young together with adult mites were found abundantly on the twigs and bark of the elms in the Department grounds. On May 9 of the same year, it was found to infest the leaves of the red clover in great numbers throughout the city of Washington. The clover leaves, especially the older ones, had a sickly appearance as if attacked by a fungus; the younger leaves showed very clearly, however, that this appearance was caused by some species of insect, and at first sight seemed to be the work of a micro-lepidopterous leaf-miner, but closer inspection showed it to be the work of a mite, of which quite a number were found on the leaves, chiefly on the upper sides, where they extracted the juices as they slowly crawled along, leaving behind them a discolored narrow line of irregular windings which imitated to perfection the mines of certain *Tineidæ*.

In December of the same year, also, eggs, which afterwards proved to belong to this species, were found very commonly on the bark of apple trees in the Department orchard.

Since 1879 these mites have been observed every spring and summer, chiefly on clover, but also on various trees, notably Apple, Elm, and Peach; and in the fall and winter, on or beneath the bark and at the angles of the branches of trees, occurring in connection with numerous eggs and young in various stages of development. The mites and eggs occur on all rough-barked trees examined in the grounds of the Department, and particularly on Apple, Elm, Arbor-vitæ, and Black Locust. Their blood-red eggs have frequently been observed in numbers sufficient to impart a reddish color to the trunks and branches of the infested trees.

In the Eastern States but one account of its infesting houses has been brought to our notice. Mr. George N. Kimball, of Waltham, Mass., writes, sending specimens, under date of May 24, 1884, as follows:

We have occupied the house in which the inclosed mites were obtained but for a few weeks and do not know how long they may have been about * * * The mites have not been found in any of the rooms except the sitting-room and parlor, but are quite numerous under the bay windows of these rooms. A few are also found under other windows and on the mop-boards.

In the central States the inconvenience occasioned by their presence in houses has been more frequently reported, as the following references show:

Specimens of this mite were received from our Indiana agent, Mr. F. M. Webster, May 7, 1886, who reported them to be abundant on Red Clover; and in June of that year Mr. Webster found them in numbers on grass (Timothy ?), which they were seriously injuring. May 28, 1888, he reported them to be disagreeably abundant in houses, where they occurred in myriads, and in the spring of the year following they were similarly numerous. A description of these outbreaks is given by Mr. Webster in *INSECT LIFE*, Vol. I, pp. 277-279.

Accounts of similar occurrences, together with specimens, have been received from A. H. Mundt, Fairbury, Ill.; Mrs. H. S. Perry, Elgin, Ill.; L. H. Ellis, Wellington, Ohio (see letter with reply in *INSECT LIFE*, Vol. II, pp. 278-279); C. C. Stoltz, Greenville, Ohio; E. M. Mackemer, Creston, Iowa; and others.

Of the many accounts with specimens received from Western States, in no case have the mites been reported to enter dwellings, but have always been found on fruit and other trees.

December 12, 1879, apple-twigs bearing the eggs of this mite were received from Mr. Wickson, editor of the *Pacific Rural Press*, San Francisco, Cal., and the larval mites issued early the following year, beginning to appear January 26.

March 29, 1880, additional specimens of eggs, this time on the bark of the Almond, were received from Mr. Wickson. The specimens were collected in Santa Clara County, Cal., by Prof. H. B. Norton, who reported that they were quite abundant in that locality. These eggs were hatching when received, and the young continued to appear during April.*

Additional specimens of eggs and young on the Almond have been received from G. W. Barnes, San Diego, Cal., our agent, Albert Koebele, Alameda, Cal., and on the Plum, from C. H. Dwinwelle, Berkeley, Cal., and Prune, from J. H. Casterline, Santa Rosa, Cal. The latter sending, in addition to eggs and young, included one adult mite. The adults were also obtained by Professor Comstock in California in October of 1880.

A very interesting lot of eggs was received August 14, 1889, from H. W. Turner, Valley Springs, Cal., who forwarded us a piece of the bark of Cottonwood absolutely covered, and several layers deep, with what are evidently the eggs of this mite. Mr. Turner writes of these eggs as follows:

Eggs on Cottonwood, Tuolumne County, Cal., 8,000 feet elevation; collected July 21, 1889. These eggs are mostly deposited on the south side of the trunks of the Cottonwood (the one common at from 6,000 to 8,000 feet everywhere in Sierra Nevada, with rounded leaves), near the base. At least 50 square feet of these eggs were seen, and from the specimens sent you, you can easily approximate their numbers.

* Numbers of the young mites were placed on an orange tree infested with *Aspidiotus gloveri* and Mealy-bugs, but none were observed to attack the scale insects which it was at first thought they might do since they were found on trees infested with scales of various kinds.

These eggs are identical with those heretofore mentioned, and any doubt as to their parentage was removed by the discovery of several cast skins of the larval and partly-grown mites about and on them. From these eggs was bred a very interesting Tineid moth, a number of larvæ of which were found burrowing in and feeding on the eggs. At the time of writing, none of these eggs have hatched.

Specimens identical with the last were received June 14, 1888, from Mrs. H. S. Reynolds, of Willis, Mont., concerning which she writes:

I send you a specimen of interest to us and it may be to you. My husband found it on McCarthy Mountain, at an elevation of about 7,000 feet, on living Aspen trees. I at first thought it red snow-plant, but under a glass it proved to be a mass of eggs just hatching. They look like spiders, but have only six legs.

When received by us but a few dried and shriveled mites could be found. These eggs were as abundant as, and were identical with, those already referred to, collected by Mr. Turner at an even greater elevation on the Sierra Nevada Mountains, in California.

The tree mentioned is probably the same in both instances and, on the authority of Professor Fernow, is without much doubt *Populus tremuloides*.

The occurrence of the mites in Oregon and Utah is shown by the following:

May 28, 1889, Mr. E. Shipley, James Valley P. O., Oregon, sent us twigs bearing young and one full-grown mite, and he reported the mites to be very abundant on boards, stones, fences, and fruit trees.

July 19, 1880, Professor Comstock found what is evidently the same mite infesting the apple-trees at Salt Lake City, the eggs, young, and nearly-grown mites occurring abundantly on leaves and twigs. On the under side of the leaves, along the midrib, a fine web was spun, beneath which and attached to it cast skins of the mites were found. The largest of the mites collected at Salt Lake City by Professor Comstock are somewhat less in size than the ordinary adult *B. pratensis*, and, while evidently having undergone the final moult had not yet reached complete development. No variation in structural details occur and they may, with little doubt, be referred to the species under discussion.

Habits and Life-history.—As would be naturally expected, the wide range of this mite gives it a somewhat variable habit.

In the more northern regions and at higher elevations the winter is passed principally, if not altogether, in the egg state. The mites, or the last brood (there are evidently several broods) come to maturity in the fall and deposit their eggs on the trunks and branches of the trees frequently in sufficient numbers to entirely cover the bark of the trunk and branches to a height of several feet. The young mites issue during March and April following.

In the cases referred to above of the occurrence of the eggs in California and Montana at an elevation of 7,000 to 8,000 feet, the issuance to the young was delayed, evidently by the cold, till from the 1st to the 15th

of June. The California specimens, collected July 31, 1889, have not hatched and it is quite possible, in view of the prior hatching of the eggs from similar localities in Montana, that the former eggs, either from severe cold or other causes, have been killed, although they are still fresh and healthy in appearance.

Professor Comstock found nearly full-grown specimens at Salt Lake City on apple trees in July, together with eggs and young, which would indicate two broods there at least.

In Indiana, Iowa, Ohio, and Massachusetts large numbers of the last brood of mites winter over, and the fall and spring wandering of these in search of food or shelter doubtless accounts for the invasion of dwellings so frequently reported. The swarming or massing in Europe of an allied species, *Petrobia lapidum*, is referred to by Mr. Webster in the article cited above.

In Vol. I, No. 10, of *INSECT LIFE* we mentioned the record by the *New Zealand Farmer* of the damage occasioned by a congeneric insect to the leaves of the Apple in New Zealand; and our agent, Mr. Webster, in the course of his recent Australian mission, had his attention called to the work of a similar mite on various fruit-trees in Victoria (see *INSECT LIFE*, Vol. I, p. 363).

At Washington, the mites abandon the clover and leaves of trees early in October and secrete themselves, especially, in crevices in the bark and under loose bark of various trees. In these situations they may be found abundantly during the fall and winter in connection with eggs and (sparingly) young of various stages. It is thus seen that breeding is hardly interrupted in this latitude during the winter months.

Food-plants.—The foregoing notes indicate that this mite is a very general feeder. Many of the trees on which it has been found, however, evidently serve but to furnish winter quarters, and are not especially attacked by the young and adults during the summer months.

Of the forage plants, Clover and Timothy (?) are especially attacked; the former being perhaps the ordinary food-plant of the mite. Of trees, the Apple and Arbor-vitæ are frequently infested with all stages during summer, and the occurrence of eggs and adults in fall and winter on Almond, Plum, Prune, Poplar, Elm, and other trees would indicate that these are also attacked.

Remedies.—In the case of its occurrence on fruit or shade trees it can doubtless be controlled or destroyed by spraying with the kerosene emulsion, to which sulphur may be profitably added at the rate of 2 or 3 ounces to the gallon of the wash. In the case of forage crops, spraying would be impracticable and no effective method of combatting the pest can at present be given.

The importance of this mite arises chiefly, however, from the annoyance occasioned by its infesting houses, and this "inconvenience," to put it mildly, can be avoided, or the mites that may have effected an entrance may be destroyed, by the use of the following measures which

have been already recommended in our replies to various correspondents:

In the event of an invasion of these mites, the lawns about the buildings, and, if practicable, the sides of the buildings, should be sprayed with the kerosene emulsion. The lower portion of the building, walls, etc., may be treated with pure kerosene with advantage. These applications should be repeated every day or two, or as often as necessary to destroy or repel the mites. Infested houses may be freed by spraying with benzine, which may be used freely without danger if care be taken that no fire is present, as this substance vaporizes rapidly and is highly inflammable. A thorough airing will remove all traces of the odor of this substance.

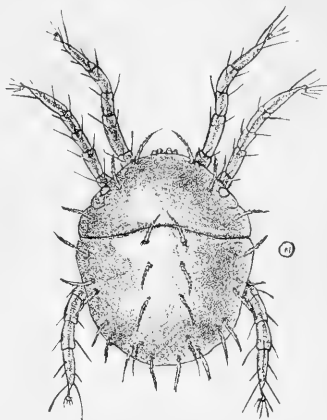


FIG. 5.—*BRYOBIA PRATENSIS*: Newly-hatched larva—greatly enlarged. (Original.)

DESCRIPTION OF VARIOUS STAGES.

Egg.—0.19^{mm} in diameter, spherical, slightly flattened at base; color, vermilion; shining; placed singly or, more commonly, in masses covering bark of trees to a depth of from one to three layers.

Young Larva.—0.18 by 0.22^{mm}, nearly circular. Color red (vermilion). Surface irregularly striate. Three pairs legs, all 5-jointed, not exceeding body in length, second and last joints longest; the first pair of legs slightly exceeding the others in length; tarsi surrounded with six knobbed hairs, two at the tip and the other four near the base. Eyes two, situated on a reddish-purple triangular spot a little back of the center and near the edge of the cephalothorax. Cephalothorax one-third less in size than abdomen. Scale-like appendages of the adult occur on the larva in same number and position, but are more elongate, being more in the nature of serrate spines; frontal processes wanting, but in place of them occur two serrate spines projecting forwards. The position of the spines on the body is as follows: Two projecting from the anterior extremity, one in front and one behind eyes; one at anterior angle, two pairs closely placed near lateral margin, three arranged in triangle near posterior margin of abdomen, three pairs on dorsum of abdomen; making in all 28 spines.

Later Stages.—The full complement of legs, as also the anterior scale-tipped projections, appear after the first or second molt; the legs in relative length and in length of joints approach those of the adult, but are shorter and stouter; the scales of body also become like those of adult. Little change in color occurs until nearly full size is reached.

Mr. Garman's species are described as follows:

Bryobia pratensis, n. s., H. Garman.

Body oval in outline as seen from above or below; but little elongated. Outline as seen from side also oval, increasing in depth towards the posterior extremity, where it is abruptly truncated. Strongly convex above, much less so below. Entire surface rugose, with more or less parallel, wavy striae. Striae of dorsal surface of abdomen coarser and more regular than those of the ventral surface and of the cephalothorax.

With scattered, curved, finely denticulate, scale-like appendages attached to the dorsum and at the margins. These scales expand uniformly from their bases to their

tips, where they are widest and have slightly rounded denticulate margins. The four conical prominences which extend forward over the mouth parts at the anterior extremity of the cephalothorax, each bears one of these scales. The two median prominences are longest, and are united at their bases. Palpi very stout; the basal articles with a few long hairs; inner ramus of forceps thumb-like and with spinose hairs; outer ramus a strongly curved hook.

Legs with strong, plumose, spine-like hairs on their basal articles, which hairs grow less and less stout towards the distal extremity of the limbs until upon the distal articles they form long, slender setae. Anterior legs equal to the body in length, tapering but slightly to the distal extremity. Two basal articles about equal, the proximal slightly the longer. Third article longest, twice the length of the sixth. Fourth article nearly as long as the sixth, about half the length of the fifth. Adhesive hairs fewer and more slender than those of the other legs. Legs of the three posterior pairs much shorter than the anterior, and with less difference in the lengths of the articles composing them.

The eyes consist of two approximated ocelli on each side of the cephalothorax. Adults in life marked with red and black. The pattern has been destroyed by alcohol. The majority of those examined have large anal protuberances.

Length of body .038 inch; width of same .025 inch.

With the above, another mite, similar but paler and smaller, was frequently taken in meadows. It is thus described by Mr. Garman:

Bryobia pallida, n. s., H. Garman.

A small, pale species agreeing with *B. pratensis* in general form. Anterior legs slightly longer than the body, with the fourth article markedly shorter than the sixth. Scale-like appendages somewhat wider and shorter proportionally. Two outer of the frontal processes wider at their tips than those of *B. pratensis*. Median pair of processes more slender than the outer and united for half their length. Color, whitish. Length of body .024 inch; width of the same .015 inch. Occurs with the preceding on grasses in meadows. The anal protuberance is conspicuous in most of the examples seen.

Additions to Description of Adult.—Length, 0.70 to 0.82mm.; width, 0.55 to 0.57mm.; in specimens collected in fall and winter, the dorsum is concave, slightly elevated toward the middle, the lateral edges being quite sharp, and even in the most distended specimens this appearance is not entirely obliterated. The rami of forceps may be best described as upper and lower, the hook being above; in mounted specimens their position is frequently as shown at Fig. 4, c, with the hook forming apparently the inner ramus.

"The long setae" of the distal articles of the legs are prominent only in the case of the first pair of legs; with the following pairs the hairs on the last articles approach more nearly those of the other joints; with the exception, however, that from near the tip of the outside of the distal article of each leg spring two long, curved hairs, in length more than one-half that of the article, and these prominent hairs occur also in the earlier stages of the insect.

The comparative length of the six articles of the anterior legs may be shown by the following numbers, counting from the basal article: 4, 2, 20, 8, 16, 9.

There is in different specimens a slight variation in the length of the articles, but their relative length is practically uniform. The eyes, as already indicated for the larva, are situated in a triangular reddish-purple spot, from which they probably take their color by reflection, since when viewed from the side they are colorless. Color: Abdomen dorsally, central spot on the hind margin of the cephalothorax and a lateral oblique mark directed forward, purplish-black; anterior and lateral portions of cephalothorax, lateral edge and sometimes central dorsal portion of abdomen, sternum and legs vermillion.

Projecting ventral (anal) portion of abdomen large, and with prominent triangular or oval anal opening (Fig. 4, b).

The position of the scale-like appendages of the adult agrees with those of the larva, with the exception that the place of the anterior pair of spines of the larva is taken by the projecting scale-bearing appendages of the cephalothorax of the adult.

The character of these scales is shown in Fig. 4, i, from the outer cephalothoracic prominence *j* from the inner and *h* from body.

REPORT ON AN OUTBREAK OF THE ARMY WORM, AND ON SOME OTHER INSECTS AFFECTING GRAIN, IN MARYLAND.

By WM. H. ASHMEAD.

In accordance with Professor Riley's instructions, on May 31, accompanied by Mr. Albert I. Hayward, of the Maryland Agricultural College, I started for Salisbury, Wicomico County, and Princess Anne, Somerset County, Md., to make such observations on the Army Worm (*Leucania unipuncta*), then depredating in the vicinity of these places, as the limited time at our disposal should permit.

During our journey, we ascertained in conversation that the worms were most numerous in the immediate vicinity of Princess Anne, and we took the most direct route for that place.

As we approached our destination we began to see the effects of the worms' work; just before entering the town we passed by a large field of corn, owned by Mr. H. H. Deshields, containing about 12 acres, that had been devastated by them, and only a few green plants could be detected, here and there, in the field.

This field was in marked contrast with another corn-field adjacent, which had been saved from attacks by ditching, as recommended in the Third Report of the U. S. Entomological Commission. Another thing observed, was that this field was flanked behind with a wood that evidently prevented their ingress that way, whereas the former was contiguous to grass and wheat fields, in which the worms are said to originate.

Just before entering the town, we passed another 10-acre corn-field, owned by Mr. John L. Lormer, that but a short time previously presented a most promising appearance, but which to-day is completely "cleaned out" by the worms. It may be worthy of record, as the theory has been advanced that insects originate in just such places, that in an adjoining field were three old hay-stacks. Contrary to our expectations, we found the reports of their numbers not at all exaggerated, and the damage done is even worse than we anticipated—the Wheat, Corn, Barley and Timothy of many of the farmers being totally ruined by them.

One of the most interesting places for observation we visited was that of Wm. J. Porter, a practical and energetic farmer, who, although he has fought the worms most vigorously, has suffered severely from their attacks. By means of ditching and by burning straw he has been able to save part of his crops, but several of his fields of Corn, Timothy and Wheat, were already ruined. He reported the worms much less numerous than they had been, but we saw many thousands in his fields.

During our rambles Mr. Porter took us to one of the ditches he had dug to keep the worms out of a large corn-field. In this ditch he had

sunk, every 2 or 3 yards apart, deeper pits, where we found the worms 2 and 3 inches deep, and the rest of the ditch was black with the dead and living worms. From the dead a fearful stench arose in such strength as to attract the buzzards, which, as we viewed the scene, were proudly sailing overhead. Various carrion-beetles, too, seemed to revel in the carnage—large Silphids and Staphylinids, besides numerous smaller forms, were quite numerous, while the hard-shelled Histerids were quite plentiful, working through the putrid masses.* Several carabids were observed running through the ditches, preying on the living and dying, *Scarites subterraneus* Fabr. being particularly noticeable, and, no doubt, with its large mandibles doing efficient service in destroying the worms.

Mr. Porter informed us that the worms always originated in the wheat and old grass-fields, and during the morning hid themselves from observation, never appearing in numbers until after 3 o'clock p. m., which accorded with our own observations and with those of the other farmers visited.

They ate up the Timothy and Corn clean, and after devouring the blades of the Wheat, congregated, three or four together, on the heads; after devouring several of the lower grains, they ate the husks and nipped off the upper portion of the kernel of the rest, thus almost entirely destroying it. If the grain is well advanced and somewhat hard it escapes destruction; but as most of the wheat visited was still in the milk, the destruction was great, and not less than 75 per cent. of the crop had been already destroyed.

Although several parasites are known to prey upon the worms, and we kept a sharp lookout for such, none were seen except a few cocoons of an *Apanteles*, which were discovered, together with the worms, under old trash and logs in a wheat-field. A few were gathered and forwarded to the Department, some of which have since hatched and prove to be *Apanteles militaris* Walsh.

The corn-fields of all this region were found to be badly infested with the larvæ of two species of beetles, and so numerous are they at times as to entirely destroy the first planting and necessitate a replanting of entire fields. The farmers call them the "Bud-worm" and do not seem to be aware that they are two distinct species that do the injury.

One species is a well-known corn pest, the larva of *Diabrotica vittata*, widely distributed over the United States; the other is one of the wire-worms, possibly the larva of a common beetle, *Drastarius elegans* Fabr., which also has an extended range, extending into Mexico. I am not aware that this latter species has ever before been reported as injurious to corn, as the larva is supposed to be predaceous on other insects. It may, though, have dual habits, not an unusual occurrence in some in-

* None of these insects were brought back by Mr. Ashmead, or determinations would be introduced.—EDS.

sects. Both of these species are more prevalent in low fields, the higher fields being less subject to their attacks.

Another beetle, found to be seriously injurious to cantaloupes and sweet-potatoes, in this region, was a Chrysomelid, *Systema elongata*, Fabr., which we found swarming in numbers, skeletonizing the leaves and frequently killing the young plants. Mr. Porter stated that he was compelled to replant on account of them.

On a neighboring farm, owned by Mr. Z. Rouch, almost as much damage had been done by the Army Worm, as on the former place. A large corn-field and a field of timothy were totally ruined. A wheat-field, farther advanced than that of Mr. Porter's, was less seriously affected, although it did not escape entirely, the blades of the Wheat and the young Timothy being entirely eaten up by them.

It was on this place that we saw the effects of the worms on Barley. Quite a large field already in head was completely ruined.

In the afternoon we visited probably the largest farm in the county, that of the Hon. D. N. Dennis, comprising 500 acres or more.

No better place existed for the proper study of the pest, as the worms were swarming in all the fields by the millions, and we had hit upon the proper time of day to see them most advantageously, 4 o'clock p. m. The ground was literally black with the crawling worms. Mr. Dennis had made no especial efforts to destroy them, although, like some of his neighbors, he had surrounded some of his fields with ditches in an attempt to keep them out of adjoining fields. I believe it would have been quite practicable to have destroyed many thousands with poisonous washes, or, as Mr. Porter did, by burning straw in the ditches, as the bottom of the ditches were black with worms.

This farm is divided by a central lane, on either side of which are fields of wheat, corn, grass, oats, etc., and in passing through this lane we found the worms quite plentiful, crawling almost invariably in the direction of the prevailing wind.

One of the first fields we passed was an immense wheat-field already in the head, and the worms could be plainly discernable on the ground all through it and on the stalks and heads. The worms having already devoured the young timothy and other tender plants usually found growing there, the blades of the wheat, the husks, and a goodly portion of the kernels, evidently could not find sufficient food and were now migrating to pastures new, the sides of the field being black with moving hosts seeking more nutritious food.

These, as well as all the others observed, were moving in a south-westerly direction, the direction of the prevailing wind. They were apparently in all stages of growth, from little fellows not more than a quarter of an inch long to the fully matured larvæ, and all got over the ground and every obstacle in their way with the most surprising rapidity. The fences, posts, and other obstacles in their way were no obstruction to their migratory instinct, or their search for food. The

fence rails and posts were often covered with crawling worms, sometimes not less than a dozen worms being found on the top of a single tall post, while others were seen going up one side as others were going down the opposite. Some specimens were even found under the loose bark on the posts and rails, where they had probably crept for shelter. One specimen thus found was in the jaws of a large hairy spider, *Salticus* sp.

Adjacent to this wheat-field was a large field of Timothy, containing 17 acres, the blades of which had been cut off by the worms as clean as cattle could have done. Mr. Jones, the overseer, informed me this field would have harvested not less than three tons of hay to the acre; but now it would not pay for the cutting.

At one side of this field, the side next the wheat, the worms had congregated in countless numbers, every square foot having not less than 30 to 50 worms. The worms were now coming out of this field and going into the adjoining wheat-field and crossing the lane into the opposite fields in great numbers, and it was here that we observed a flock of the common English sparrows and a few robins picking out the smaller worms and feeding on them. Mr. Jones informed us the English sparrows had been thus busily engaged all the past week, and it gives us pleasure to record here this fact in favor of the despised bird.

Some distance off from this field was another one of wheat, containing probably 20 acres, in which the worms were even more numerous, and they had already sufficiently injured it to render the crop unprofitable to harvest. A deep, broad ditch had been dug along one side, and it was now, about 5 o'clock p. m., black with worms. It seemed to us a pity that these worms were not killed, as many of them were able to crawl up the sides and escape into adjoining fields.

Facing this field was a large corn-field of probably 75 acres, of which 50 acres had already been destroyed, and there was but a slight chance that any of the corn still left would escape, although by ditching an effort was being made to save it. Of the 50 acres destroyed 30 acres had already been replanted, and in the newly plowed portion the worms were seen moving about in all directions, having just entered it from the adjoining wheat; it is probable that most of these will die of starvation or from the effects of the hot sun in the middle of the day.

We were particularly struck with what Professor Riley has written about the Army Worm not feeding on Clover. Of the several clover-fields we saw the worms passed entirely through them, eating the Timothy, other grasses, and some weeds, but leaving the Clover almost untouched. A few of the leaves and some of the heads were slightly eaten, but no appreciable injury was observed. Only once did I actually observe a worm eating it, and that was a single half-grown specimen curled up on the head devouring the most palatable portions.

The present outbreak seems to be quite local, within a radius of 10 to

15 miles, and of the origin and previous outbreaks we ascertained but little. All the farmers and others interviewed concurred in the opinion that the winter of 1889-'90 had been unusually mild and dry, and a few reported having observed the worms feeding on warm days during the winter.

On the following day we visited Salisbury, but found nothing of importance to prolong our stay there. Messrs. L. Malone and W. B. Tighlman informed us that the army worm had not as yet appeared on any of the farms in the immediate vicinity, and no serious injury had been done nearer than 3 miles.

Mr. Tighlman reported the oat crop of this whole region this year a total failure from the depredations of the Grain Aphis, *Siphonophora avenæ* Fabr.

SOME OF THE BRED PARASITIC HYMENOPTERA IN THE NATIONAL COLLECTION.

(Continued from page 18.)

Subfamily Euphorinæ.

<i>Parasites.</i>	<i>Hosts.</i>
<i>Perilitus gastrophysæ</i> Ashm.....	<i>Gastrophysa cyanea</i> Mels. Columbus, Ohio, June 2, 1886.
<i>Euphorus sculptus</i> Cr.....	<i>Megilla maculata</i> DeG. Washington, D. C., June 24, Aug. 29, Sept. 12, 1884. From same beetle, by F. M. Webster, La Fayette, Ind., July 21, Aug. 18, 1884.

Subfamily Meteorinæ.

<i>Meteorus coquillettii</i> Ashm	<i>Agrotis</i> sp. ? Los Angeles, Cal., July 3.
<i>Meteorus orchesiæ</i> Ashm	<i>Orchesia castanea</i> Mels. Grand Ledge, Mich., July, 1881.
<i>Meteorus vulgaris</i> Cr	<i>Omphalocera cariosa</i> Led. on Paw Paw. St. Louis, Mo., Oct. 5, 1873. <i>Tetralopha platanella</i> . Kirkwood, Mo., Apr. 15, 1887.
<i>Meteorus notodontæ</i> Riley MS.....	<i>Heterocampa subalbicans</i> Grt. St. Louis, Mo., Oct. 28, 1874.
<i>Meteorus brevicaudus</i> Ashm.....	<i>Cecidomyious</i> ? gall on Oak. St. Louis, Mo., June 1, 1872.
<i>Meteorus euchromiæ</i> Ashm.....	<i>Euchromia criphia</i> Fabr. Caracas, Vene- zuela, Sept. 23, 1886.
<i>Meteorus</i> sp. ?	Tineid larva on <i>Hamamelis</i> . Kirkwood, Mo., May 29, 1886.
<i>Meteorus</i> sp. †	<i>Cacoecia fervidana</i> Clem. on Oak. St. Louis, Mo., Oct. 24, 1874.

Parasites.

Hosts.

Meteorus communis Cr.....	<i>Botis penitalis</i> Grt. St. Louis, Mo., Sept. 15, 1875. <i>Gelechia pseudacaciella</i> Chamb. on Locust. Washington, D. C., Nov. 11-29, 1879. <i>Datana integerrima</i> G. & R. Washington, D. C., July 21, 1880. Found also in Texas.
Meteorus œcopsidis Ashm.....	<i>Æcopsis</i> sp.? Kirkwood, Mo., Aug. 10, 1885.
Meteorus floridanus Ashm.....	Arctiid larva. Cocoanut Grove, Fla., May, 1887.
Meteorus dimidiatus Cr.....	Tineid on Willow. St. Louis, Mo., May 27, 1867. <i>Agrotis subgothica</i> Haw. Washington, D. C., Mar. 7, 1882. Found also in Michigan.
Meteorus indagator Riley MS.....	<i>Pionea rimosalis</i> Guen. Oxford, Miss., Sept., 1880.

Subfamily Calyptinæ.

Eubadizon pleuralis Cr.....	<i>Coleophora</i> sp.? on Oak. St. Louis, Mo., July 15, 1877. Tortricidous borer in twig of Apple. Kirkwood, Mo., Oct. 24, 1887.
Eubadizon phymatodes Ashm.....	<i>Phymatodes amœnum</i> Say on Grape. Kirkwood, Mo., Apr. 11-16, 1889.
Ganychorus atricornis Ashm.....	<i>Andricus</i> ? on <i>Quercus Douglassi</i> . Marion Co., Cal., 1885.
Ganychorus orchesiæ Ashm.....	<i>Orchesia castanea</i> Mels. in woody fungus. Grand Ledge, Mich., 1881.
Ganychorus gelechiæ Ashm.....	<i>Gelechia prunifoliella</i> Cham. Kirkwood, Mo., May, 1885.

Subfamily Alysiinæ.

Aphæreta muscæ Ashm.....	? <i>Haematobia serrata</i> Desv. Washington, D. C., Aug. 8-10, 1889. Puparium of another Muscid. Washington, D. C., July 7, 1888. Found also at St. Louis, Mo.
Aphæreta californica Ashm.....	Dipteron in roots <i>Typha latifolia</i> . Los Angeles, Cal., Sept., 1886. <i>Oscinis malvæ</i> ? Burg. Jacksonville, Fla., 1886.
Aphæreta oscinidis Ashm.....	<i>Oscinis</i> on <i>Plantago major</i> .
Adelura dimidiata Ashm.....	<i>Anthomyia brassicæ</i> Bouché?, in stem of Cabbage. Ames, Iowa.
Adelura subcompressa Ashm.....	Ovipositing in Dipterous larvæ in fungus. Los Angeles, Cal., July 16, 1886.

Subfamily Dacnusinæ.

Dacnusa oscinidis Ashm.....	<i>Oscinid</i> miner on Honeysuckle. Kirkwood, Mo., Apr. 6, 1885.
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<i>Parasites.</i>	<i>Hosts.</i>
<i>Dacnusa confusa</i> Ashm	Dipterous miner in leaves of Wild Rice. Monroe, Mich., July, 1881.
<i>Dacnusa flavocincta</i> Ashm	Dipterous leaf-miner on Wheat. Andersonville, Tenn., May 5, 1884.
<i>Synaldis ulmicola</i> Ashm	Dipteron on trunk of Elm. Washington, D. C., Oct. 14, 1878.
<i>Cœlinius meromyzæ</i> Forbes	<i>Meromyza americana</i> Fitch, in stems of Wheat. Indianapolis, Ind., July 18, 1883. Collected also at Ames, Iowa.
<i>Cœlinius</i> sp. var. ? <i>meromyzæ</i> Forbes	<i>Meromyza americana</i> Fitch. Ottawa, Canada, July 21, 1889.

Subfamily **Macrocentrinæ.**

<i>Macrocentrus pædisca</i> Riley MS	<i>Pædisca scudderiana</i> Clem. Richfield Springs, N. Y., May 23, 1887, and Buffalo, N. Y., June 25, 1884.
<i>Macrocentrus gelechiæ</i> Ashm	<i>Gelechia epigæella</i> Cham. on <i>Vaccinium</i> . Washington, D. C., Aug. 28, 1882.
<i>Macrocentrus pectoralis</i> Prov	<i>Pædisca</i> sp. ? on <i>Solidago lanceolata</i> . Washington, D. C., June 6 and 21, 1884.
<i>Macrocentrus solidaginis</i> Cr. MS	<i>Cacœcia fervidana</i> Clem. on Oak. St. Louis, Mo., July 6, 1877. Tortricid on Black Oak. Lansing, Mich., July 4, 1887.
<i>Macrocentrus delicatus</i> Cr	<i>Carpocapsa pomonella</i> (L.). St. Louis, Mo., July 10, 1872. <i>Cacœcia fervidana</i> Cl. on Oak. St. Louis, Mo., July 7-17, 1873. Tortricid leaf-roller on Cotton. Crescent City, Fla., 1880. <i>Acronycta oblinita</i> S. and A. Washington, D. C., Oct. 1, 1880. Collected also in Texas and North Carolina.
<i>Zelee nigriceps</i> Riley MS	<i>Crambus zeellus</i> Fernald. La Fayette, Ind., July 11, 1886.
<i>Zelee atriceps</i> Riley MS	<i>Coleophora</i> sp. on Hickory. Washington, D. C., Sept. 16, 1886.

Subfamily **Diospilinæ.**

<i>Promachus saperdæ</i> Riley MS	<i>Saperda candida</i> Fab. Indiana.
<i>Promachus rubriceps</i> Ashm	<i>Sternidius alpha</i> in Sumach. Washington, D. C., Feb. 14, 1884.

Subfamily **Opiinæ.**

<i>Phædrotoma sanguinea</i> Ashm	<i>Trypeta</i> in fruits of <i>Solanum carolinense</i> . Washington, D. C., Oct. 3, 1885.
<i>Opius anthomyiæ</i> Ashm	<i>Anthomyid</i> , mining leaves of Dock. Lansing, Mich., June 23, 1887.
<i>Opius mellipes</i> Prov	<i>Lophoderus incertana</i> Robs. Kirkwood, Mo., Sept. 25, 1881.
<i>Opius foveolatus</i> Ashm	Leaf-miner on Pigweed. Ames, Iowa.
<i>Opius floridanus</i> Ashm	Leaf-miner on Artichoke. Jacksonville, Fla., June 15.

Subfamily Ichneutinae.

<i>Parasites.</i>	<i>Hosts.</i>
Ichneutes fulvipes Cr.	<i>Euura?</i> on Willow. Ft. Grant, Ariz., Mar. 28, Apr. 7, 1882. <i>Saw-fly</i> on Willow. A. J. Cook, Lansing, Mich.

Subfamily Toxoneurinae.

Toxoneura minuta Cress	<i>Gelechia prunifoliella</i> Cham. on Peach. Kirkwood, Mo., Oct. 8, 1884.
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Subfamily Aphidiinae.

Praon humulaphidis Ashm	<i>Siphonophora</i> sp.? on Hop. Richfield Springs, N. Y., June 15, 1887.
Aphidius prociphalus Ashm.....	<i>Prociphilus</i> sp.? on <i>Pinus inops</i> . Washington, D. C., Apr. 7, 1883.
Aphidius pterocommae Ashm	<i>Pterocomma salicicola</i> Uhler on Willow. Washington, D. C., Apr. 5, 1883.
Aphidius avenaphis Fitch	<i>Siphonophora avenae</i> Fab. Glendower, Va., June 17, 1882, and La Fayette, Ind., June 24, 1889.
Aphidius lachni Ashm.....	<i>Lachnus</i> ? on Poplar. Alameda, Cal., Nov., 1887.
Aphidius phorodontis Ashm.....	<i>Phorodon mahaleb</i> Koch on Peach. Washington, D. C., June, 1888, and Ottawa, Canada, 1889.
Aphidius xanthus Ashm.....	<i>Cecidomyiid</i> gall on blossom of <i>Solidago</i> . St. Louis, Mo., Sept. 23, 1876.
Lysiphlebus ribaphidis Ashm	<i>Myzus ribis</i> L. on Currant. La Fayette, Ind., July 12, 1886.
Lysiphlebus cucurbitaphidis Ashm.....	<i>Siphonophora cucurbitae</i> Thos. La Fayette, Ind., Nov. 6, 1885.
Lysiphlebus eragrostaphidis Ashm.....	Aphid on <i>Eriogonum fasciculatus</i> . Los Angeles, Cal. <i>Siphonophora</i> on <i>Audibertia stochoides</i> . Los Angeles, Cal. Swept from <i>Eragrostis</i> . La Fayette, Ind., Nov. 4, 1885.
Lysiphlebus coquillettii Ashm.....	<i>Myzus</i> sp.? on <i>Hosackia glabra</i> . Los Angeles, Cal.
Lysiphlebus citraphis Ashm	<i>Toxoptera</i> on Orange. Brooksville, Fla., April 26, 1879; also from Rock Ledge, Fla., April 12, 1880; Jacksonville, Fla., and Crescent City, Fla. <i>Dactylopius citri</i> Boisd. Washington, D. C., Oct. 4, Nov. 20, 1884.
Lysiphlebus myzi Ashm.....	<i>Myzus ribis</i> L. Lansing, Mich., and La Fayette, Ind.
Lysiphlebus testaceipes Cr.....	<i>Aphis gossippii</i> on Cotton. Selma, Ala., May 19, 1879; Washington, D. C., Oct. 30, 1879; Fremont, N. C., July 20, 1880; and Wedgefield, S. C., July 24, 1886.

<i>Parasites.</i>	<i>Hosts.</i>
<i>Lysiphlebus gossippii</i> Ashm.....	<i>Aphis gossippii</i> on Cotton. Selma, Ala., Oct. 7 and 8, 1880, and Columbia, S. C., Dec. 26, 1888.
<i>Lysiphlebus abutilonaphidis</i> Ashm.....	<i>Siphonophora rosæ</i> Reaum. Los Angeles, Cal. <i>Siphonophora</i> on <i>Abutilon</i> . Los Angeles, Cal.
<i>Lysiphlebus tritici</i> Ashm.....	<i>Siphonophora arenæ</i> Fab. Glendower, Va., June 20, 1882, and Cadet, Mo., May 10, 1882. <i>Toxoptera graminum</i> Rond. ? on Wheat. Mebane, N. C., Feb. 30, 1890. <i>Aphis</i> sp. ? on roots of Wheat. La Fayette, Ind., Oct. 14, 1888.
<i>Lysiphlebus persicaphidis</i> Ashm.....	Aphid on Peach. Fresno Co., Cal., May, 1886.
<i>Lysiphlebus baccharaphidis</i> Ashm.....	Aphid on <i>Baccharis viminalis</i> . Los Angeles, Cal.
<i>Lysiphlebus salicaphis</i> Fitch.....	<i>Siphonophora viticola</i> Thos. St. Louis, Mo., June 18, 1873, and Washington, D. C., Sept. 10, 1886.
<i>Lysiphlebus minutus</i> Ashm.....	<i>Aphis gossypii</i> on Cotton. Fremont, N. C., July 22, 1880.
<i>Diæretus americanus</i> Ashm.....	<i>Siphonophora avenæ</i> Fabr. La Fayette, Ind.
<i>Diæretus ferruginipes</i> Ashm.....	<i>Siphonophora avenæ</i> Fabr. La Fayette, Ind.
<i>Diæretus brunniventris</i> Ashm.....	<i>Siphonophora avenæ</i> Fabr. La Fayette, Ind.
<i>Lipolexis rapæ</i> Curtis = <i>piceus</i> Cr.....	<i>Aphis brassicæ</i> L. Bluffton, S. C., May 12, 1884. <i>A. brassicæ</i> L. St. Louis, Mo. <i>Aphis</i> on <i>Brassica campestris</i> . Los Angeles, Cal., Apr. <i>Aphis</i> on Turnip. St. Louis, Mo. Collected also at Jacksonville, Fla., and La Fayette, Ind.
<i>Lipolexis salicaphidis</i> Ashm.....	Aphid on <i>Salix</i> . Los Angeles, Cal.
<i>Lipolexis chenopodaphidis</i> Ashm.....	<i>Aphis</i> sp. ? on <i>Chenopodium album</i> . Los Angeles, Cal.

DESCRIPTION OF CERTAIN LEPIDOPTEROUS LARVÆ.

By HARRISON G. DYAR, *Rhinebeck, N. Y.*

Nola sexmaculata Grote.

Before the last molt the young larva is like the mature one but the black patch on the eyes is absent, only a small spot is present in the triangular plate in front of the head and the two other marks are fused. The mouth is brown, the eyes black. Width of head .7^{mm}. The body is pale greenish-yellow and lacks the subdorsal line. The warts in rows (1) and (2) are black, the rest concolorous with the body. Length 8^{mm}.

Mature larva.—Head round, partly withdrawn within joint 2, pale yellowish and marked with black so thickly as to appear nearly all black. Maxillæ brown. Two large vertical black spots separated by the central suture; a large spot at each side of the

head covering and extending behind the eyes; a smaller one before it, narrowly separated from it, from the vertical patch and by the pale suture from the black triangular plate above the mouth. Width of head nearly 1^{mm}. Body somewhat flattened, robust, of nearly uniform width, but joint 13, smaller. Thoracic feet rather slender, abdominal present only on joints 8, 9, 10, and 13. Cervical spot black, bisected, curved behind, each part containing in front a yellow wart. Three rows of warts, one per segment, the second wart on joint 2, small:—(1) above subdorsal line, (2) below it, (3) substigmatal, and a fourth row, small, concolorous with the body situated below the subventral fold above the bases of the legs. All bear a few fine white hairs, those at the extremities of the body, long. Body pale yellow in color, a black dorsal shade band and a fainter subdorsal one, the latter seen by a lens to be broken into somewhat oblique portions, neither reaching the extremities. Rows of warts (1) and (2) are partly black and partly pale brown, row (3), ocher. Length 12^{mm}.

The cocoon is constructed on a piece of wood from little bits of the bark, thus exactly resembling it in color. It is flat at the sides and narrow, tapers upward from the posterior end and is truncate anteriorly at the end where the moth emerges. The little pieces of bark of which it is composed are about three times as long as wide, are laid on regularly lengthwise, not overlapping, and fastened with silk. Length 12^{mm}, width 2^{mm}, greatest height at truncated end 2.5^{mm}.

The pupa is cylindrical, the last segments rounded and without cremaster, but a few fine short hairs sparsely distributed. Color light brown.

Food-plant.—Witch-hazel (*Hamamelis virginica*). There is only one brood a year, the larvæ forming their cocoons about the 1st of July. The moths appear early the subsequent spring. During their whole history the larvæ eat only the upper surface of the leaf, leaving the veins and lower epidermis almost untouched.

Larvæ from Dutchess County, New York.

Nerice bidentata Walker.

Mature Larva.—Head, flattened at the sides, a little depressed at vertex; green, with a black line on the angle between front and sides, which is shaded with white posteriorly; some irregular white marks in front and at the sides, the principal one being a line in front bordering the triangular plate and continued irregularly to the vertex subparallel to the central suture. Mouth and antennæ pale; ocelli black; a few short whitish hairs. The body does not reach the vertex of head for joints 2 to 4. Joints 5 to 13 have each a dorsal process somewhat modified in shape on the several joints. Those on joints 6 and 12 are the longest and rise abruptly in front from the suture before the segment, terminate at the top in two rounded points of a yellowish color tipped with brown, of which the anterior one is the larger and longer, and slope evenly to the posterior edge of the segment. The other processes are similar in structure and coloration, but are shorter, the two tips rather closer together, and tend, on the posterior segments, to become cleft on the dorsal line. This is first distinctly seen on joint 9, becomes more prominent on the succeeding segments, while the process on joint 13 lacks the posterior tip and the brown coloration, and consists of two short points placed side by side. Color of body leaf-green, the subdorsal space covered with greenish white, but leaving the ground color to appear as a dorsal band and an oblique line on each joint. The white color is continued down the sides nearly to the spiracles. A faint, fine, pale stigmatal line. Spiracles white with a fine black border. On joints 2 to 6 and 13 are indications of a dark red subventral line. Abdominal feet pale reddish, marked with two black lines; thoracic, green with a black line.

Food plant.—Elm (*Ulmus americana*). The species is double-brooded in this State, and the winter is passed in the pupa. Larva from Dutchess County, New York.

Schizura ipomœæ Doubleday.

Mature Larva.—Head higher than wide, flattened a little in front, not distinctly bilobed; pale brown, with a band from vertex of each lobe composed of two black lines inclosing a space of the ground color, in which is a pulverulent bluish line.

Triangular plate, labrum, and the bases of antennæ pale; outside of jaws and antennæ testaceous; inside of jaws and eyes black, the latter on a whitish ground. A few black hairs. Body of nearly uniform width, slightly rising dorsally on joints 2-4; on joint 5 a long, pointed dorsal process. Joints 7-10 are arched, joint 9 the highest and somewhat humped. The body slopes to joint 11, and at joint 12 is again humped, from whence it tapers to the anal feet. Rows of tubercles, one per segment, each bearing a black hair as follows:—(1) in subdorsal space on joints 5-12; (2) subdorsal, two tubercles on joint 13, (3) superstigmatal; (4) substigmatal; (5) and (6) in subventral space, only one on joint 13, but others on the anal plate. All are small and whitish except in row (1) on joints 5, 9, and 12, where they are orange-red. On joint 5 they surmount the process and are long, pointing upward; on joint 9 rather far apart and surmounting two subconical elevations, and on joint 12 nearer together, surmounting the hump. Body pale brown, mottled with many fine crinkled lines of red brown; all of joints 3 and 4, except a dorsal band, green with small black spots laterally. On the posterior part of joint 5, on joints 6 and 7, and the anterior part of joint 8 is an elliptical, creamy white dorsal patch, a little retracted at the segmental sutures and containing three crimson lines. It is supplemented by two white dorsal dots on joint 8. Bordering the patch posteriorly, from joint 7, is a broad blackish dorsal band, continuous on joints 8, 9, and 10, but interrupted on joints 10 and 11 by the usual V-shaped mark. This mark is broad, creamy white, containing some crimson lines and consists of a subtriangular patch on joint 10 posteriorly and two oblique subdorsal bands on joint 11, between which is a small white dorsal spot. The blackish dorsal band fills in the space between these marks and is continued more narrowly than before to the anal plate. On joints 10 and 11 it has a decided green tinge. The mottlings on the ground color are much darker on the dorsal line on joints 2-4, on the base of the process and anterior edge of joint 5, bordering the anterior part of the pale patch on joints 5-8, and in the subventral space. Spiracles brown, paler centrally in a fine black border. Thoracic feet reddish; abdominal concolorous with the body and furnished with a few hairs. The anal feet are partly aborted and are held out straight. Venter pale yellowish on joints 6-13. Length, 30^{mm}.

Food-plants.—Maple (*Acer*), Beech (*Fagus*), Witch-hazel (*Hamamelis*), Linden (*Tilia*), and probably others.

Larvæ from Dutchess County, New York.

Mamestra confusa Hübner.

Head pale brown; the lower part of labium and bases of antennæ white; antennæ black; eyes and jaws dark brown. Body semi-transparent, pale whitish, minutely but rather thickly flecked with white. A white dorsal, subdorsal, stigmatal and substigmatal line; a row of large crimson lateral spots, one per segment, except on joint 13; those on joints 2-4 centered with black, the others minutely with white. Spiracles white, bordered by a fine black line; a few short black hairs. Cervical spot blackish. Feet normal.

The larva remains concealed by day in a hollow nest composed of a leaf and silk and comes forth to feed. It is not gregarious, and usually but one is found on the same plant.

Food-plants.—Maple (*Acer*), Willow (*Salix*), Hickory (*Carya*), Apple (*Pyrus*), Birch (*Betula*), and others. I have never found the larva on anything but a tree or bush—contrary to the habits of other species of this genus, which eat herbaceous plants.

EXTRACTS FROM CORRESPONDENCE.

Chilo saccharalis: Its Injury to Corn in Virginia, and to Cane and Sorghum in Louisiana.

I send you by this mail a small package containing some worms, which are proving very destructive to the corn crop around here. Some farmers report their crops totally ruined and many others much injured. Ours is very much damaged. The way the worms attack the stalk is unlike anything of the kind I have ever seen. They attack anywhere from the the tip end of the tassel down to the root in the ground. Above the ground they just eat off the hard coating and nibble the blades; below the ground and just on a level with the surface they bore through and through the stalk, generally in several places. The stalk does not die for some time, and remains green, but the blades soon drop and hang down from the stalk. The worms vary greatly in size, color, and shape, but have all the same habits. I send four in the package in different stages of development. The beetle or fly that lays the egg I have been unable, so far, to find.

Please write me what you know about this destructive insect. It is now too late to save this crop, as they have already done much mischief, but I would like to know if there could be anything done to keep them off in the future. My description of them has been written in great haste, and is not very full. If you would like more information, I shall be glad to answer any questions.—[W. J. Morton, Nottingham Farm, near Fredericksburgh, Va., July 8, 1890.]

REPLY.—I beg to acknowledge the receipt of your letter of the 8th instant, and of the accompanying specimens of corn-stalks which have been bored by some worms. The matter proves to be a very interesting one, for the reason that the insect which is doing the damage is the Tropical Sugar-cane Borer (*Chilo saccharalis*), which damages sugar-cane in Guiana, the West Indies, and Louisiana. In 1881 it was found to damage corn in Mississippi, Georgia, and as far north as South Carolina. It has never hitherto been recorded further north than Columbia in the last-named State. The insect is referred to in the Annual Report of this Department for 1880, pages 243 to 245. As there stated, the borers hibernate in the larval state in the old corn-stalks; and the custom which prevails in many parts of the South, of leaving the old stalks standing in the fields after harvest, renders this hibernation easy and the consequent multiplication of the insect possible. The most satisfactory remedy, therefore, will be to put the stalks out to fodder early, and have the uneaten portion burned before early spring. The stubble should be plowed up and burned, or plowed under very deeply. The eggs are laid by a straw-colored moth. It is of course too late to attempt any remedial measures this year.—[July 10th, 1890.]

ANOTHER LETTER.—I have about forty-five (45) experimental field-plots of small size in tropical cane and sorghum. It is desired to protect these, at all hazards, against the tropical cane-borers, which were very numerous and damaging here last year, and which I anticipate will do yet more harm the present season as a result of an open winter. Will you kindly suggest means for their protection? The whole area in these experiments does not exceed one (1) acre. As I am unfamiliar with such matters, it may be necessary to describe the method of application, as well as to name the remedy. For example, if Paris green will do the work, kindly mention best apparatus for its use, and where obtainable, period best for application, quantity to be distributed, etc. Such would be highly appreciated, I assure you. Sorghum appears to be far more viciously attacked than tropical cane.—[W. J. Thompson, Calumet Plantation, Bayou Teche, La., April 9, 1890.]

REPLY.—Yours of the 9th has just come to hand. Unfortunately we know very little about the exact periods of development of the tropical cane-borer in your part of

the country beyond what was ascertained in 1881 at Dr. Wilkinson's place. We know, however, that there are several generations in the course of the summer, probably at least a half-dozen; and, as in the case of all many-brooded insects, there will be a constant overlapping of broods, so that moths will be flying most of the summer. This means an almost continuous egg-laying, and your only absolute protection, where the moths are abundant and breeding, will be to spray with Paris green at frequent intervals. In an experiment of this kind you will not mind taking considerable trouble, and I would therefore advise you to purchase a "Little Climax" pump with outfit from the Nixon Nozzle and Machine Company, of Dayton, Ohio, and to spray with Paris green in the proportion of one-quarter of a pound to 40 gallons of water. I would spray at intervals of from two to three weeks, and oftener when heavy rains intervene. I am surprised to learn that sorghum is more viciously attacked than tropical cane, and should be very glad to have a note from you upon this insect for publication. I should particularly like your criticism upon the paragraphs on remedies, on pages 10 and 11 of the little bulletin on Insects Injurious to Sugar-cane, which was published after my return from your plantation in 1881.

Lest you have not a copy of this bulletin by you I have had the paragraphs in question copied and inclose them herewith.—[April 12, 1890.]

Another Beetle destructive to Carpets.

I presume the inclosed specimens are not new to an entomologist, although to me and my neighbors they are new. I have resided in several states north and south at different times but I never happened to meet any of these fellows before. We have found the larvæ very destructive to carpets, woolens, etc., and were unable to discover the perfect insect until by putting the larvæ in a bottle we in time developed them into the little black bug which you see. Any information which we can get regarding best methods of offense or defense against these little pests will be gratefully received. These insects may be dead when they reach you but I presume you will recognize them all the same. I am not certain whether I should send these specimens to the "Smithsonian" or to the Agricultural Department, but presume, if I am wrong, they can be put on the right track there.—[D. Strunk, Mankato, Minn., July 1, 1890.]

REPLY.—The insect is one of the Dermestid beetles (*Attagenus piceus*) that feeds on animal substances, and may be killed by chloroform or bisulphide of carbon. Camphor or, still better, naphthaline will prevent further attacks of this pest. In habit and transformations this species closely resembles the true carpet beetle (*Anthrenus scrophulariæ*) and the same preventive and remedial measures given for that species (INSECT LIFE, Vol. II, No. 5, Nov. 1889, pp. 127-130) will answer.—[July 9, 1890.]

Other Insects under Carpets.

I sent you this morning some larvæ found under carpets in my house. Both kinds are new to me, or possibly, the brown one is a stage of the longer jointed one. Will you be good enough to give me the name or names, and if described in "INSECT LIFE" please state where it can be found.—[J. B. Brinton, Philadelphia, Pa., March 29, 1890.]

REPLY.—Your letter of March 29 is duly received, together with the accompanying specimens of larvæ found under carpets. The long, many-jointed larva found by you belongs to the Dipterous genus *Scenopinus* and is probably the larva of *S. pallipes*. The larvæ of these flies are very long and slender and are peculiar in that the abdominal segments, except the last, have the appearance of being double, so that the body, exclusive of the head, seems to be 22-jointed. These larvæ have been occasionally found beneath carpets or in woolen blankets, and they have also been found in rotten wood. Professor Riley has also recorded the finding of larvæ of *Scenopinus* in human expectoration. The fly is black with a metallic hue.

The brown larvæ which you suppose may be a stage of the longer one belongs to

Attagenus piceus, a beetle very closely allied to the common carpet beetle or buffalo moth (*Anthrenus scrophulariae*), of which an account was given in a recent number of INSECT LIFE. *A. piceus* has been recorded as injuring feathers in pillows and beds. This insect doubtless is not essentially different in habit from the well-known carpet pest just mentioned, and the same means may be employed against it.— [April 1, 1890.]

Locusts as Food in Madagascar.

I send you with this letter some specimens of our migratory locust of Madagascar. You will see that we have to deal here with a particular species, *Pachytylus migratorioides*, Reich., variety *capito* Sauss. For the *Malgaches* (natives), these locusts, which they call in their language *Valala* are at the same time a scourge and a resource; a scourge by reason of the ravages done to the crops, and a resource in that they furnish food for the lower classes and animals. Thus it is true, that Providence with every ill disposes something of good.

When the flight of the *Valala* is observed, men, women and children, armed with receptacles of various kinds, hasten to make ample collections of these insects, which they obtain chiefly by setting fire to the vegetation. What is not collected and carried away is left to the "*Gouika*" (*Corvus scapularis*) and to the "*Papanyo*" (*Milvus olgyptius*), which, I am informed, are very fond of this kind of food. After being collected the *Valala* are thrown into large pots and submitted to a thorough stewing, after which they are spread out in the sun on mats until they are perfectly dry. It is then, after the legs and wings are removed, that the *Valala* are ready to be stored to supply the wants of the household, and they are moreover a common current commodity in the markets.

The *Valala* prepared in this manner may, it is said, be preserved for a considerable time. The *Malgaches* eat the *Valala* fried in grease, and in the form of "*Ro*" or soup, with which they season their rice. To have a perfect dish of this kind, after the feet and wings and also the head of the *Valala* has been removed, they are soaked for half an hour or thereabouts in very salt water before they are fried in grease. I have tasted the *Valala*, but believe that the dish will never be popular for the civilized palate.

It seems to me, however, that, used as a condiment, in sauce for example, the powder or flour of the *Valala* and other locusts may be very well employed in connection with other foods. The migratory locust may be employed, if I mistake not, as food for various domestic animals.

M. le Général Comte de La Croix de Vaubois has stated that it is known that fowls feed on the locusts eagerly during the passage, and he thought the locusts would, if properly preserved, furnish a very suitable food for them. * * *—[P. Camboué, Tananarive, Madagascar, April 25, 1890.]

Insects noxious to Cotton in Egypt.

As the cotton exported from Egypt to the United States might possibly contain the eggs of noxious insects I call your attention to the following description of the three cotton pests which are most common here, by Dr. E. Sickenberger, Professor in the Medical School:

I. THE COTTON-WORM OR LEAF-EATER.

(*Prodenia littoralis* Boisd.)

This moth, the length of whose body is 16 millimeters and the transversal dimension when the wings are extended about 30 millimeters, has its upper wings of a brownish color, mixed with gray and cream color, its lower of a yellowish-white with a brown line on the lower edge. It passes the winter in the state of a reddish-

brown chrysalis in a light cocoon buried in the soil. The eggs are laid at the beginning of spring on the most different plants and trees; the caterpillar is therefore omnivorous. During the cotton season the moth prefers to lay its eggs on the cotton plant. The eggs are massed on the under surface of the leaves in spots containing from 200 to 300, covered with down and grayish-yellow scales.

About a week after being laid the eggs hatch, and in about three days the young caterpillars seek the tenderest parts of the plants and bury themselves in the young buds and pods, which they quit when about one-third developed to feed afterwards exclusively on the leaves. The young caterpillars are of a pale green and slightly hairy. They then grow grayish, the hair is no longer perceptible, and their length attains about 4 centimeters and their breadth 5 millimeters.

This development is accomplished in from sixteen to twenty days, when they bury themselves in the earth, where they enter the chrysalis state, out of which in a week come the moths. A fall in temperature retards and an increase of heat accelerates the duration of these phases. The adult caterpillars have the habit of burying themselves in the earth at the foot of the plant during the hottest hours of the day. This insect is the principal ravager of the cotton plant, but it is when the caterpillar is young that it does the greatest damage by destroying the buds and the ovaries of the young capsules, and when one wishes to fight the worm it is of the utmost importance to act at the moment the eggs are laid, or at least immediately after they are hatched, because if the young caterpillars once get into the pods they are sheltered from any substance which may be applied to destroy them.

The destruction of the leaves of the cotton plant by the adult caterpillars is but a slight damage compared with the destruction of the pods by the small caterpillars.

Of all the remedies which I have tried that which produced the best and surest effect is the following: Make a mixture of 10 per cent. raw carbolic acid at 30°, of 10 per cent. powdered ammoniacal alum (avoid ferruginous alum), and of 80 per cent. of an inert product such as ordinary plaster. Spread this on by hand at the rate of about 85 to 90 pounds per acre.

This preparation, when made with acid of the necessary degree of concentration, kills the worms without injuring the plants; only it should be applied when the dew has disappeared, otherwise the plant being still damp, the tender shoot might be burned. The picking off of the leaves before the eggs are hatched has a good effect, but taking away the caterpillars when the plant is already attacked is almost useless.

II. THE GNAWING MOTH.

(*Earias insulana* Boisd.)

This little moth also passes the winter in the state of a red chrysalis in a cocoon shaped like a boat, and having a nankeen or gray color and a silky tissue. This cocoon is attached to the dry shoots or to the branches of the cotton plant. The moth is about 12 millimeters long and has a breadth of about 20 millimeters with the wings extended. I have observed that during the summer most of them have the upper wings of a light green, whilst in autumn and spring they are pale yellow, often with grayish brown or violet spots or lines. The lower wings are of a shining white. These differences in color are not due to the difference in sex, because during my observations I have often seen moths coupling, both of which were of the same green color.

The females lay their eggs in spring on the young capsules. The caterpillar has sixteen feet and attained a length of 15 millimeters and a diameter of 5 millimeters. Its color is olive-brown. It has a glistening black head, with a yellowish face and a white stripe on the middle of the back, the under part of the body being of an ash-gray color. The skin is covered with white and orange-colored spines, interspersed with fine and rather long hairs.

This caterpillar gnaws the inside of the tender stalks, and in autumn does great damage by destroying the inside of the pods. The only means of fighting this worm is to burn the dry stalks of the cotton plant, a means proposed by the late Joanovich Bey and practiced by order of Mr. Gibson.

By this proceeding the caterpillars which are passing their winter in the chrysalis state are destroyed and ashes are obtained.

This caterpillar escapes every method of destruction by staying in the inside of the plant.

III. THE COTTON BUG.

(*Oxycarenus hyalinipennis* Costa.)

It is found on many plants, particularly around the Mediterranean. It is of an elongated ovoid shape, and is brown or blackish in color. These bugs are found in great numbers in the ripe pods of the cotton plant. I have observed that they suck the sap from the base of the young pods and from the blossoms and thus prevent their development; they attack also the seeds when they are tender, which results in a diminution of the germinative strength, and consequently a diminution in the product of the plants.

Besides these injuries, these insects, by pullulating in the cotton, make it dirty and communicate to it their characteristic and disagreeable smell. Among these various insects it is the leaf-eater (*Prodenia*) which makes the greatest ravages in the cotton plantations, and although the alum-carbolic treatment destroys the worm in a sure way, it would be better to seek a cheaper and more simple remedy. The use of ashes of the cotton plant might perhaps be tried with success in doses of a hundred weight per acre, whether pure or mixed with a small quantity of carbolic acid.

They should be used while the worms are still very young, or even before they are hatched. Up to the present I have never tried this substance, and I beg cultivators who are in a condition to make the experiment to try it this year, in order to arrive at a conclusion. By burning the dry stalks of the cotton plant to obtain their ashes not only would the gnawing worm be destroyed but a product would be obtained, which, spread on the fields, would be at the same time a manure for the plant and a poison for destructive insects.—[Eugene Schuyler, Agent and Consul-General, Cairo, June 2, 1890.]

A beneficial Beetle on Orange Trees.

We send by to-day's mail a box containing bugs that are found on orange trees, also on Peach and in the cracks of ripe fruit. Will you please name them for us and let us know whether they are injurious or otherwise?—[E. O. Painter, De Land, Fla., April 21, 1890.]

REPLY.—Yours of the 21st ult. has been received, together with the accompanying specimens of insects found upon Orange, Peach, and in the cracks of ripe fruit. This insect is the common *Epitragus tomentosus*, mentioned upon page 75 of Hubbard's report on "Insects Affecting the Orange." The early history of this beetle is unknown, but its larva probably lives on the ground among oak leaves. The adult beetles are carnivorous and feed upon scale-insects of all kinds. It is, therefore, beneficial and not injurious.—[April 28, 1890.]

Aspidiotus perniciosus.

I forward by to-days mail specimens of apple and pear tree bark taken from trees in the orchard of J. M. Gose, of this place. The disease with which these trees are affected is new in this section, having made its appearance last year for the first time. The first symptoms are minute white and brown scales on the outside, and when cut the bark shows red or black spots. The fruit buds show red where it should be white, and even the fruit is affected the same way. The disease spreads rapidly from tree to tree, appearing first on the larger limbs and quickly making its way to the

smaller ones, finally killing the bark and eventually the tree itself. It was first noticed on trees which were bought from a New York State nurseryman. If some remedy is not soon applied it is feared the disease will spread throughout the Walla Walla fruit belt. Will the Department kindly give me the cause and preventive of the disease? Can trees be saved which are in the first stages of the disease? Please communicate with me at your earliest convenience and the remedy, if any, will be published in "*The Washington Farmer*" for the benefit of the fruit growers of the Walla Walla Valley and entire northwest.—[Wm. M. Freeman, Walla Walla, Washington, March 24, 1890, to Mr. Van Deman, Chief of Division of Pomology.]

REPLY.—Mr. Van Deman, the Pomologist of this Department, has referred your letter of March 24, relating to the new apple and pear-tree pest, to this division for reply. The specimen of bark taken from the trees in the orchard of J. M. Gose proved to be infested with a scale insect known as *Aspidiotus perniciosus*. This scale has been recorded as very injurious in California and Nevada. It is described and figured in the Report of the Department of Agriculture for 1880, page 304. It is further discussed in the report for 1881-'82, pages 65 and 207. I think by careful application of the following-described remedies you will be able to prevent further injury by it. The best means against scale-insects, as shown by long experience in the work of the division, is the emulsion of kerosene and soap, a formula for the preparation of which is inclosed on separate sheet. In California experiments have been made by agents of the Division which show that resin formula (see INSECT LIFE, Vol. II, No. 4, Oct., 1889, p. 92) may be used with the best of results against scale pests and Aphides.

Numerous experiments have been made with one part of the compound to 8 parts water, and this strength for most purposes will be sufficient. Both the resin wash and the kerosene emulsion should be applied by means of a force pump and spray nozzle. Any good nozzle that will cause the liquid to break into a fine mist-like spray will answer the purpose.

The bug inclosed with the bark is the Twice-Stubbed Lady-bird (*Chilocorus bivulnerus*), a well-known enemy of many injurious insects, including scale insects and Aphides, and it was doubtless engaged in devouring the scales on your trees.—[April 1, 1890.]

The Sow Bug.

A small 14-legged crustacean (*Oniscus*) is very destructive to low growing flowering plants in my garden and those of my neighbors. Would you please inform me if you know of any way of getting rid of them outside of crushing them with hand or foot? Will send you specimens of the little pest if you so desire. It is especially fond of flowers of violets and hearts's-case or pansies.—[G. Kohn, New Orleans, La., April 19, 1890.]

REPLY.—We shall be glad to receive specimens of the *Oniscus* of which you complain, and beg to ask you if you are perfectly sure that this is the creature which is damaging your flowers and plants. In other words, have you seen it at work? A full account of its damage will be acceptable to us and we shall be glad to publish a note on the subject if you will favor us with the result of your observations. They are popularly supposed to feed mainly if not entirely upon decaying vegetation. Do you find that they feed at night or not? With a little more information from you we may be able to suggest a remedy.—[April 22, 1890.]

Traps for the Winter Moth again.

There is one point in reply to which, if you are quite willing, I should much like to be allowed to insert a few lines.

It is to the paragraph headed "Traps for the Winter Moth Useless," p. 289 of March number of "INSECT LIFE" for 1890. Mr. R. McLachlan is mentioned as having stated that traps which aim at destruction of the males of the *Cheimatobia brumata* are useless, as enough will remain to fertilize the winged females. This I should have con-

jectured to be a well-known fact, but it is not this point which we are in any way working on, in any of the prevention details which I am myself acquainted with. Our difficulty, as you will see mentioned in my 13th report, if you will kindly turn to page 67, is the transportation of the females in the act of pairing by the winged males to the trees. This is a point much observed in this country, and I have to-day once again had my attention drawn to this difficulty in the matter of prevention by a Somersetshire correspondent who, in confirmation of his observation, has preserved the *pair* in his collection. It is solely to meet this difficulty that we use tarred boards and lights in any preventive operation with which I am connected.

I do not see the *Gardeners' Chronicle*, and I am not in communication with Mr. McLachlan, or I should have replied in my own country and given the necessary explanation, but (if you approve) I should much like to be allowed to insert the above observations, otherwise the various superintendents and myself might appear to your readers (whose good opinion I should like to merit) as wonderfully ignorant of what I believe is a well known fact.—[E. A. Ormerod, Torrington House, St. Albans, England, April 10, 1890.]

The Clover *Phytonomus*.

I will send you by to-morrow's mail specimens of some kinds of worms, which on the 24th of this month I found in great numbers in our clover fields. They ate small, round holes in the leaves, which you will notice in those I send you. These holes were what first attracted my attention to them; fully one-half or more of the leaves are thus bitten, and I am sure I could have found fifty or more of these creatures on a space not more than 1 yard square. It was between 6 and 7 o'clock a. m. when I saw them on the 24th, and they were feeding. To-day I went out about noon to get some specimens, but could not find them more than one-tenth as abundant as the other day. This is a nice warm day, and perhaps the warm sun drove them to the roots for shelter. As they are something new in our neighborhood I send them for a name.—[W. Stewart, Landisburg, Perry County, Pa., April 28, 1890.]

REPLY.—I beg to acknowledge the receipt of your letter of the 28th ult., together with specimens of the insect which is injuring your clover. A glance at these larvæ show that they belong to the species known as the Clover Leaf-beetle (*Phytonomus punctatus*). This insect was probably imported to this country from Europe some thirty years or more ago, and in 1881 became noted as a pest in Yates County, N. Y., and it has since spread considerably. The insect hibernates in the young larva state and any mode of winter warfare that will crush or burn them during the winter will considerably reduce the number of the species the ensuing season. If the field is badly infested it will pay to make an effort to burn the stubble, even if straw has to be strewn over the field. Fortunately a fungus disease has taken hold of this species with great avidity, and every specimen which you sent had been killed by it. It may be that the disease will practically destroy the insect with you, so that no remedy will be necessary. If you will kindly inform us as to the future developments, you will place us under obligations. You will find an account of this insect in the Annual Report of the Department for 1881-'82, pages 171 to 179, and it is figured upon Plate X of the same report.—[May 1, 1890.]

ANOTHER LETTER.—Yesterday two students of Franklin and Marshall College brought me the inclosed specimens, wanting to know what they were and what to do about them. They are on the grass in the campus of the college. They disappear at night (or during rain) and appear during the day, twisting their bodies around the blades and devouring them. They appear to be the larva of a species of "saw-fly," so far as I can make them out, as they appear in the bottle. Some of the farmers state that this insect was present in destructive numbers about twenty years ago. So far as I am able to recall the case, that worm was the larva of *Leucania albilinea*, and in addition to timothy and other grasses it also attacked the wheat, even "the corn in the ear" after it was standing in shocks.

The other bottle contains a small species of coleoptera, which the college students found attacking the books in the library of the college.—[S. S. Rathvon, Lancaster, Pa., May 15, 1890.]

REPLY.—The first of the specimens which you send is of considerable interest. It is not a saw-fly larva but apparently a weevil of the *Phytonomus* group. It closely resembles that of *Phytonomus punctatus*, the clover weevil which was described in my report for 1881-'2. The occurrence of one of these insects upon Timothy is something entirely new so far as our knowledge goes. We advise that you urge the two students of Franklin and Marshall College to collect as many as possible of these larvae and send them to me alive in a tight tin box with a supply of food. If the insect is very abundant it might pay to send one of my assistants to study it. Please inform me as to this. The insect which is damaging books in the college library is the common *Sitodrepa panicea*. We would advise the use of fresh California Buhach for this insect.—[May 19, 1890.]

California Notes.

I have sent by this mail two boxes, one containing *Isosomas*, *Cynipids*, *Chalcids*, etc., and the other, grasses and galls belonging thereto. I have mislaid the seed-pods of the grass from which *Isosoma* No. 547 was bred, and will send it later. On the same grass I found a peculiar larva boring from near the top down and often into the root, where they spin a long thin transparent tube to pupate, in fact the habit is the same as the wheat saw-fly, *Cephus pygmaeus*; as yet none of the mature insects have come out.

This reminds me that while at Napier, N. Z., in a similar species of grass I found also a larva resembling this in size and habit.

In the same grass puparia of the Hessian fly were found in the Santa Cruz Mountains.—[A. Koebele, Alameda, Cal., April 18, 1890.]

REPLY.—In answer to yours of the 18th ult. with box containing *Isosoma*, etc., I will say that the *Isosoma* No. 547 is very near if not identical with *I. hordei*.

The work of the *Cephus* in the same grass as the above, is very similar to that of *C. pygmaeus*, though nothing can be said definitely till the fly has been bred.

The *Chlorops*, found boring in the stem of a grass (*Agrostis vulgaris*) in a meadow near Edgewood, Siskiyou County, Cal., must be bred before any determination can be made. Apparently the same species, forming less conspicuous galls, may be bred from the salt marsh grass in company with No. 263, (*Isosoma* sp.,) found growing near Alameda.—[May 1, 1890.]

Ants and Melons.

I called on one of my neighbors, a farmer to-day. He complained of the injury small ants were doing to his watermelon plants. They seemed to have fixed their abode in the hills and gather in quantities about the neck of the vine as it comes out of the ground, sucking the juices out of same, and causing the infested plants to look wilted. It will not do to put kerosene about the hills, I suppose, and I could think of nothing else. I promised to write you and learn what is the treatment proper.—[W. H. Edwards, Coalburgh, W. Va., June 23, 1890.]

REPLY.—Your letter of the 23d, inst. is duly received. Your informant certainly is mistaken in supposing that the small ants which were found clustering about the base of watermelon vines were doing any injury. They were doubtless attracted by the presence of aphids, probably the common melon plant-louse (*Aphis cucumeris*). If you think it worth while you might have specimens collected and forwarded so that the determination can be accurately made and recommendations as to remedies given.—[June 24, 1890.]

Fumigation for Scale-insects.

A short time ago Fruit-pest Inspector Richardson, of Pasadena, and myself paid a visit to Orange to learn more about fumigating trees with hydrocyanic-acid gas, and were shown around by President Hamilton, of the Orange County Board of Horticulture. About a dozen fruit-growers have fumigators of their own, and several of them fumigate for their neighbors at so much an acre, while some of them rent their fumigating outfits to other growers. All I spoke to on the subject expressed themselves as being highly pleased with the results obtained by this process. It comes the nearest to extermination when applied to the red scale of any process known to me, and one of the largest orange growers at Tustin informed me that after he had sprayed his trees three times there were more living red scales on a single lemon than could now be found in his entire orchard, the latter having recently been fumigated with the hydrocyanic-acid gas. He also informs me that it costs but little more to fumigate his largest trees than it did to spray them. Two different kinds of fumigators have been patented, but I did not see one of them in use, the growers using fumigators of their own devising, modeled after the one first constructed by Messrs. Wolfskill and Craw, of this city.—[D. W. Coquillett, Los Angeles, Cal., July 1, 1890.]

A Parasite of the Vine Aspidiotus.

I send some bottles containing larvæ in alcohol, and a few more slides with specimens for the microscope. Among the latter is an interesting parasite on *Aspidiotus uva*, which seems to be doing good work in keeping this pernicious scale-insect in check. More than a dozen of these little flies emerged from the scales on a bit of grape cane not 5 inches long.

In one of the bottles is a section of a *Plusia* larva found on Chrysanthemum, from which thousands of the minute flies inclosed with it issued. I never saw a more extreme case of parasitism. After spinning up the poor worm lost all semblance of itself. A myriad of the parent flies must have attacked it at once.—[M. E. Murtfeldt, Kirkwood, Mo., November 23, 1889.]

REPLY.—The parasite on *Aspidiotus uva* is a species of *Centrodora*, while the *Plusia* parasite is probably *Copidosoma truncatellum* Dalm. * * —[December 3, 1889.]

Some Insects from Kansas.

I inclose you two specimens of insects for identification. I have found four of the smaller of the two crawling about the house during the last week. I should like to know if it is the true curculio or not. The larger one with red markings is found abundantly in the fall about box-elder trees, but as I have never seen it feed I thought that perhaps it is a relation to the wheel bug pictured in INSECT LIFE, and therefore a predaceous insect and consequently beneficial. This last is seen all winter on sunny days crawling about, especially getting into houses whenever it can.—[F. F. Creve-cœur, Onaga, Kans., March 31, 1890.]

REPLY.—Your letter of March 31 has been received together with the accompanying specimens of insects for determination. The smaller one which you thought might be the plum curculio is an entirely distinct insect, although it resembles that species and belongs to the same family. It has no common name but bears the scientific name of *Dorytomus mucidus*. It is a very common western beetle and breeds in the catkins of Cottonwood. The larger specimen with red markings, which you found abundantly in the fall about box-elder trees and later in the winter about houses, is the Box-elder Bug (*Leptocoris trivittatus*). This is also very abundant in the west and is known to breed chiefly on the Box-elder. It also attacks other plants, and in Bulletin 12 of this Division is recorded as seriously injuring apples. Ordinarily, however, it is not particularly injurious, but is frequently very annoying by reason of its entering houses in the fall and winter. Its habit of congregating on

the trunks of Box-elder and other trees will make it comparatively easy to operate against. It may be destroyed by crushing with a stiff brush or broom or by applying strong kerosene emulsion or hot water.—[April 7, 1890.]

The Joint Worm in northern New York.

I send you some pieces of straw that contain maggots of some kind. I have heard of their being in but one piece of wheat and that man did not find them until this winter while feeding the straw. My wheat was very much injured by frost and this man thought that was what was the matter with his wheat crop, but it proves to be something else. I write to hear if you have seen or heard of anything like it, what you call it, and what you think it will amount to?—[K. W. Russ, York, Livingston County, N. Y., March 13, 1890.]

REPLY.—The insect damaging your neighbor's wheat is the common Joint Worm *Isosoma hordei*, which does considerable damage to the wheat crop in some parts of the country, but which has not been a serious pest in your State. From past experience, therefore, it is not likely that you will have much trouble. In case the insect increases, however, so as to do any appreciable damage, the farmers over a given territory should unite in burning stubble, screenings, and straw for one or more seasons.—[March 17, 1890.]

The Grain Toxoptera in Tennessee.

In your letter of January 21 you state that you wish me to keep you informed as to the increase or decrease of *Toxoptera graminum*. I inclose two clippings from our county paper, and am happy to state that they have not been able to survive the heavy rains and frosts of this month, so far as I can see. We are greatly relieved, for, although you say you doubt whether much damage would be done, the wheat-fields seem to show the contrary, and patches in size of an acre or more were apparently dead. I have one field which I doubt will ever recover from the damage done. So much for T. g. at present. Should they make their appearance again I will let you know.—[P. C. Newkirk, Jalapa, Monroe County, Tenn., March, 1890.]

REPLY.—Your letter of recent date inclosing clippings duly received. Thank you very much for your further information relative to the grain plant-lice. I am glad that my anticipations were verified and that the lice have disappeared.—[March 14, 1890.]

Prevalence of the Grain Toxoptera in Texas.

I ship by to-day's mail some insects that are infesting our wheat fields of this county, many fields being almost ruined. The effect is just the same as the Chinch Bug on corn. When the first crop has matured they look very much like the "Pharaoh," or seventeen-year locust. They are about one-eighth of an inch long and can jump or fly. The young one I send you seems to be doing the mischief, there being as many as three to each branch of wheat. No one seems to know what these insects are or how they are likely to terminate. We would be pleased to have your Division examine them and advise us at once, and give us all the information you can, as wheat is the main dependence for a large part of the State.—[J. L. Fookes, Era, Cooke County, Tex., February 26, 1890.]

REPLY.—Your letter of recent date, inclosing specimens, duly received. The insect in question is one of the grain plant-lice known as *Toxoptera graminum*. This insect, although hitherto comparatively rare, has been very abundant in the wheat fields in Kentucky and Tennessee the past winter, although in these States the recent frosts have almost entirely destroyed it. The life history of the species is not well known and no remedy can be suggested at this time. I shall be glad to hear from you as to the amount of damage done by this insect, and as to how long it is abundant in your fields.—[March 18, 1890.]

SECOND LETTER.—Your letter of information in regard to the wheat-destroying insects in this community is at hand, for which you will accept the thanks of the farmers of this county. You ask for the amount of damage done to the crop and how long they have abounded in our fields. It is believed now that they have been in the fields since early fall, and they still remain in great quantities in some fields. As to the amount of damage done to the crops, after a careful estimate we place the damage at 75 per cent. in one-half of this county, which includes the wheat belt. One-half will be planted in other crops and the remainder will be about one-half stand. There are some small crops of what is known as Fultz wheat; this is not hurt. The rest of the crop is Mediterranean wheat. Can you give any reason for this? If so, you would oblige us.—[J. L. Fookes, Era, Cooke County, Tex., March 31, 1890.]

REPLY.—I take pleasure in acknowledging the receipt of your favor of March 31, together with newspaper clippings relating to the Wheat Louse (*Toxoptera graminum*), and am much obliged to you for the additional information relating to the amount of damage occasioned by it. As stated in a former letter, this insect has a wide range, extending from Maryland to Texas, but has been heretofore comparatively rare. We first received specimens in 1882, and it has since then been found near here in Maryland. It has also been reported several times from Indiana, and specimens have been received from South Carolina, Tennessee, and Kentucky.

We have received specimens at all times of the year, from January to July. There is very little doubt but that this species is the one named above, which occurs commonly on the continent of Europe, where it is frequently destructive to grasses and grains. In 1852 it was recorded to have been so abundant in the streets of Bologna, Italy, as to cause great annoyance to the inhabitants. The fact that this pest is with little doubt an imported one, and its excessive abundance over a wide area, makes a knowledge of its habits very desirable, and it is hoped that during the coming summer opportunity will offer to thoroughly study it in the field. Any assistance you can offer in the way of observations during the spring and summer will be gladly received, and I shall also be glad to get additional specimens of the lice, for the sending of which I inclose return franks. Many insect pests, after periods of unusual abundance, suddenly disappear, owing to the great increase of their natural enemies, and this is especially true with the Aphides, or plant-lice, and has been frequently noted in case of the well-known Grain Aphis (*Siphonophora avenæ*). We may therefore hope that this insect, which is a near ally of the Grain Aphis, will disappear after the present year and not be troublesome again for some time.

The immunity of the Fultz wheat is doubtless explained by some peculiarity of its epidermis, or skin, which protects it against the lice or renders it distasteful to them, and this protection is very probably caused by the presence of numerous minute hairs, which prevent the louse from readily puncturing the stem with its sucking beak. In view of this, would it not be desirable to grow the Fultz and other wheats that experience may show to be little affected by this insect, rather than the Mediterranean?—[April 7, 1890.]

THIRD LETTER.—According to promise in my letter of the 8th instant, you will find inclosed three of what is commonly called the Lady-bug, which is claimed by Mr. F. P. Heare, of the Fair Plains neighborhood, to be the parent of the *Toxoptera graminum*. In my letter of the 8th instant I gave you my reasons for doubting Mr. H's. statement, and from an investigation made to-day I have much greater reason for doubting. In one wheat field we saw a few straggling bunches of wheat which were thickly stuck with the plant-lice, some of the smallest size, but not a Lady-bug could be found. In an oat field where were a few scattering bunches that were left by the freeze of some weeks ago, three Lady-bugs were found, but we could not find a single one of the little pest. In another part of the farm we found another Lady-bug, but not one of the pest. I then examined some oats on two other farms and found the little pests in great numbers, but a diligent search failed to find a single Lady-bug. We have interviewed a number of our best farmers and find them all inclined to doubt Mr. Heare's opinion in regard to the Lady-bug. I have no tangible idea of where our

pest comes from, and I have no remedy to offer. Should the warm weather and hot sun fail to drive them away, I think they will take both the corn and cotton. I would be glad to have your opinion as to the origin or parentage of the little pest and how long they will be likely to remain with us, so that I may give it to the press for the benefit of the farmers.—[J. L. Fookes, Era, Cooke County, Tex., April 10, 1890.]

REPLY.—I beg to acknowledge the receipt of yours of the 10th inst. and also the accompanying specimens. As I wrote you on the 11th inst., the "Lady-bug" is the enemy of the grain-lice and not its parent. An examination of the specimens which you set shows that they belong to the species known as the spotted Lady-bug (*Megilla maculata*).

Nothing more need be said in answer to Mr. Heare. The life history of one of the species of grain-lice will be treated at some length in the forthcoming annual report of this Department, a copy of which will be sent you when published. The lice may do considerable damage with you this spring, but there is no available remedy. Ordinarily they are killed off by parasites before attaining injurious numbers, although occasionally, as last year in the States of Michigan, Wisconsin, Indiana, Illinois and Ohio, the parasites did not get the upper hand until later in the year than usual, and the result was that the crop was somewhat damaged. In reply to your question as to where the lice come from, we may state that they are always with you, but usually in such small numbers as not to be noticed. The past open winter has evidently been favorable to their early and excessive multiplication.—[April 17, 1890.]

ANOTHER LETTER.—I saw in your reply to Mr. J. L. Fookes, of Era, Tex., that you asked him to report to you the extent of damage done by the insects that are on our wheat. The wheat in Cooke, Grayson, Collin and Denton counties, and a few other places where I have been, is suffering from their ravages, and it is hard to tell how long they will remain. They are on my wheat and seem to be increasing fast, and up to yesterday it was a very great mystery to my mind how they originated and accumulated so rapidly. I walked into the wheat to make a close investigation, and within an hour I discovered the great mystery which has been bothering us so long, and it is the simple little bug known all over the United States as the Lady-bug, a small red bug with a shell covered with black specks. She can be seen all over the field depositing little eggs resembling a clear grain of sand. I find these are soon hatched in the warm sun, and the little bug is very small with a transparent skin. It begins to suck the sap from the green wheat, which soon changes its color to a dark green, and as it advances in age and size it takes on the perfect shape of a Lady-bug with her shell and wings off. Next I find him a little larger and a little older with a dark streak along his back; next, larger in size, while the streak has developed into a set of wings, very fine in texture.

We had a freeze a short time ago that perhaps killed most of the little rascals, and the ones now on the wheat I have no doubt hatched since the freeze. I can not say just now whether they will turn to Lady-bugs or not, but I can convince any man in a few minutes that the Lady-bug is the cause of their existence. I opened and counted in one Lady-bug over thirty eggs. I find in all the counties that the wheat is damaged a great deal worse in valleys near timber or brush, or near where the rocks are numerous on the surface, and in sections of the black land where very large rank weeds have been growing. Wherever the Lady-bug has had shelter they have been noticed by all with whom I have talked to-day as being very numerous for the past year or two. The bugs have already destroyed in this county (Cooke) thousands of acres of wheat, and I find the Lady-bug laying her eggs on some corn that is up. Have also found the little *Toxoptera graminum*, as you call them, on the corn, too.

The most simple and effectual remedy I know of just now is this: Take corn-meal and scatter it broadcast over the wheat field, one-half bushel to 10 acres of wheat, so as to toll the little birds on the fields, and when once there they will eat the Lady-bugs and rid the wheat of the terrible pest. Please give this to the press at once, so the farmers may save what wheat remains, if possible.—[F. P. Heare, Vernon, Wilbarger County, Texas, April 6, 1890.]

REPLY.—I beg to acknowledge the receipt of your letter of the 6th inst. You are entirely mistaken in supposing that Lady-bugs are the parents of the grain-lice. Their appearance in the grain fields in such great numbers is due to the fact that they feed upon the lice. Hence your proposition to destroy the Lady bugs will result in the destruction of the farmers' best friends. That these insects are so abundant in the infested fields is a very encouraging sign and indicates that the lice will speedily disappear at least in part.—[April 12, 1890.]

Notes on Bulletin 21.

Page 12. *Re Vedalia cardinalis*.—I have already alluded to this subject in the *Garden and Field*. Still, there is no harm repeating that neither Mr. Tepper nor myself have the slightest recollection of Mr. Koebele showing us the Lady-bug on the occasion he states, but I can understand that he may have done so without my remembering it, because my thoughts were all intent on *Lestophonus*. Neither the Rev. T. Blackburn, who is strong on *Coccinellids*, Mr. Tepper, nor myself have ever seen *V. cardinalis* in our lives to our knowledge.

Page 15. *Re Diabrotica (Aulacophora punctata)*. "This gentleman claims that all injury can be avoided by dusting powdered lime over the plants." This is news to me. I certainly was not the informant. As the *Aulacophora* is not to be found near Adelaide I have had no opportunity of experimenting with it. I will bear the remedy in mind.

Page 18. I certainly informed Mr. Koebele that Mr. Maskell considered the insect on the Kangaroo Acacia that has often been mistaken for *Icerya*, as a *Dactylopina*, but he had had only 2 specimens to examine, and if I remember right he only suggested it. I have since re-examined it, and believe it to be an *Eriococcus* but the insect is now so scarce that I can not obtain any specimens. *Eriococcus eucalypti* have also disappeared unless on the tops of tall gum trees.

Page 20. *P. engenioides* should read, *eugenioides*.

Page 29. Dr. Diez should read, Mr. A. Zietz.

So much for Mr. Koebele's report the perusal of which has given me much pleasure. He certainly did his work well and, what is better, it has turned out better even than was anticipated. I hope that you may be able to send him again before long to bring us a consignment of Codlin Moth enemies and take back a general assortment of our useful insects.—[F. S. Crawford, Adelaide, South Australia.]

GENERAL NOTES.

A MUCH PARASITIZED INSECT.

A most remarkable instance of parasitism is given by Prof. C. Rudow-Perleberg, in *Die Insekten-Welt*, Volume IV, Nos. 4 and 5, May and June, 1887.

In treating of the enemies of *Cheimatoba brumata*, a common European moth, he gives a list of no less than sixty-three parasites of the family *Ichneumonidæ*, and states that he has reared an almost equal number of *Braconids* and of *Chalcidids*, and *Proctotrupids*. We give his list of *Ichneumonids*, as a matter of interest. It will be noticed that in nearly every case several species of the same genus have been bred from the single host. From this fact we might suspect that some of the so-called species may be simple varieties; but the author has studied

parasitic Hymenoptera for many years and speaks with authority. Yet some of the species, judging from analogy, must be secondary and not primary parasites.

Ichneumon fabricator Gr.
Ichneumon fabricator var.
Ichneumon saturatorius Wsm.
Ichneumon deliratorius Gr.
Ichneumon scutellator Gr.
Ichneumon pallifrons Wsm.
Ichneumon anator Wsm.
Ichneumon nigrirarius Gr.
Ichneumon ochropis Wsm.
Ichneumon tentator Wsm.
Ichneumon varipes Wsm.
Ichneumon albinus Gr.
Anomalon violatum Gr.
Anomalon tenuicorne Fbr.
Anomalon varitarse Hgr.
Anomalon geniculatum Gr.
Anomalon clandestinum Gr.
Campoplex mixtus Gr.
Campoplex melanarius Hgr.
Thersilochus harpurus Schrk.
Porizon hostilis Gr.
Porizon boöps Gr.
Porizon saltator Gr.
Mesoleius aulicus Gr.
Mesoleius sanguinicollis Gr.
Mesoleius hæmatodes Gr.
Mesoleius caligatus Hgr.
Mesoleius segmentator Hgr.
Mesoleius improbus Hgr.
Mesoleius sanguinicollis ?
Tryphon vulgaris Gr.

Tryphon brunniventris Gr.
Trematopygus nigricornis Hgr.
Polyblastus cothurnatus Hgr.
Polyblastus arcuatus Hgr.
Bassus lætatorius Fbr.
Bassus albosignatus Nees.
Bassus flavolineatus Hgr.
Bassus bimaculatus Hgr.
Bassus cognatus Hgr.
Pimpla examinador F.
Pimpla instigator F.
Pimpla varicornis Gr.
Pimpla mixta Rtz.
Pimpla longiseta Rtz.
Pimpla flavipes Gr.
Pimpla oculatoria Gr.
Cryptus atripes Gr.
Cryptus seticornis F.
Cryptus longipes Htg.
Cryptus n. sp. (*brumatae* Rudow).
Phygadeuon vagans Gr.
Phygadeuon brumatae n. sp.
Hemiteles cingulator Gr.
Hemiteles niger Gr.
Hemiteles oxyphymus Gr.
Hemiteles pectoralis n. sp.
Hemiteles socialis Gr.
Hemiteles fulvipes Gr.
Pezomachus fasciatus Gr.
Pezomachus agilis Först.
Pezomachus audax Först.

A STRANGE OMISSION.

It is very strange that attention has never before been called to the fact that "Standard Natural History" entirely omits mention of the family *Thripidae* or order *Thysanoptera*.

HABITS OF CIMBEX AMERICANA.

In a recent letter from Mr. Elmer D. Ball, of Little Rock, Iowa, he reports the following observations on the common willow Saw-fly: "I noticed in INSECT LIFE that this insect was common in Nebraska, and mention was made of the injury done to the trees by their cutting a slit nearly around the twigs. I have watched this for a number of years and can say that these slits always heal over and the tree continues to grow without apparently being injuriously affected, but when the larvæ hatch and begin eating them the growth of the tree is arrested for that year. They will strip it of all its leaves and then travel on to the next

tree. In a few days a few leaves will come out at the top of the tree and so it will remain for a month or more.

When willows have been cut back and come up rank and close together the worms do not seem to like them for the first year. They do not seem to like the creek willows but will try the pussy willow if hard up for food.

In examining the *imago* I found that one mandible had two points and the other only one. Upon examination I saw that, while working, they sink the two-pronged jaw into the wood as far as possible and work with the other on the outside."—[Herbert Osborn, Ames, Iowa, August 2, 1890.]

HONORS TO MR. WIGHT.

Our valued correspondent, Mr. R. Allan Wight, of Auckland, New Zealand, has recently been appointed Consulting Entomologist to the Bay of Islands Horticultural and Agricultural Society, and to the Papakura Fruit-growers Association in recognition of valuable information conveyed in his contributions to the *New Zealand Farmer*. Mr. Wight, although past seventy years of age, is a most energetic and indefatigable worker in the interests of New Zealand horticulture and agriculture. Moreover, his work is largely a labor of love.

LEGISLATION AGAINST THE GIPSY MOTH.

Our readers may be aware that the State of Massachusetts has taken hold of the destruction of the imported Gipsy Moth with great energy. The matter was mentioned by the governor in his message to the legislature last winter and a bill was introduced and passed appropriating \$25,000 for the work. The governor appointed three men to take entire charge of the work and we learn from recent correspondence and from articles in the *New England Farmer and Massachusetts Ploughman*, *Garden and Forest*, and *Scientific American* that a large force of men was employed early in the spring to go over the infested districts marking the trees upon which eggs had been laid. They were followed by other men furnished with torches who burned the eggs thus marked. One hundred men were employed in this labor, which lasted until May 1. The young larvæ began to appear early in May and spraying with Paris green was at once commenced. Some fifteen machines were purchased at a cost of about \$75 each. These consisted of barrels mounted on carts with pump, spray-nozzle and other accessories and from 100 to 200 feet of hose, besides ladders. The spraying was done with Paris green in the proportion of 1 pound to 150 gallons of water, and five men accompanied each machine.

One hundred inspectors were appointed whose duty it was to prevent the moths from being carried beyond the limits of the infested regions. They were divided in gangs of five each, and all teams leaving the infested locality were examined and all caterpillars found destroyed.

The territory occupied by the pest is much greater than was at first supposed, and extermination appears almost impossible. There has been no lack of energy in the prosecution of the work, but the whole matter needs scientific supervision in order that this energy shall not be wasted.

HOT WATER FOR THE PEACH BORER.

The *Prairie Farmer* for July 5, 1890, quotes a number of experiments in favor of this remedy. The balance of evidence seems to show that hot water will kill the borers around the crown and will not injure the trees; but this only corroborates a fact that has been the common possession of intelligent peach-growers for decades.

PYRETHRUM IN AUSTRALIA AND SOUTH AFRICA.

We learn from the *Agricultural Journal* (Cape Colony) of June 5, 1890, that a Mr. Kleesattel has 6 acres of Pyrethrum under cultivation in Victoria, which has begun to yield a return. The seed is sown in beds in the month of August and the following winter the young plants are put out in rows 2 feet 6 inches apart with 1 foot between the plants. The plants bloom from November to January, fifteen months after the sowing of the seed. The plant is perennial and the crops last for several years.

In 1872 Mr. J. B. Hellier planted some seed at Graham's Town, South Africa, which grew well, and it is interesting to know that without cultivation and in the same locality the plants are still to be found, so that it practically grows wild. He distributed also in 1872 small quantities of the seeds to other localities, and in each place the experience has been the same. Mr. Perks, near King William's Town, has grown it and has manufactured his own insect-powder for the past six years. Under these favorable conditions Mr. Hellier urges that the plant be grown extensively, not only for home consumption, but also as a future article of export.

THE YELLOW HAMMER AND THE CODLING MOTH.

Mr. A. P. Martin, of Petaluma, Cal., writing to the *Pacific Rural Press* of June 27, 1890, states that in looking over his orchard last spring and examining all crevices and bark of the trees for Codling Moth larvæ he failed to find any where there were thousands last fall. He discovered plenty of cocoons, but in every case the former occupant was absent. It was too early for transformation to have taken place and he found small holes in the bark-scales which had been made by some bird. His belief is that the good work was done by a bird whose scientific name he does not know, but which is variously called the "Yellow Hammer," "Flicker," or "High Hole" and which Dr. Merriam informs us is, in California, *Colaptes cafer*. During the early spring months Mr. Martin states that they were to be seen by hundreds in his orchard, industri-

ously examining the trunks and larger limbs of the fruit trees, and he also found great numbers of them around sheds where he stored his winter apples and pears. As the result of several hours search Mr. Martin found only one worm, and this one escaped only by an accident, for several had been taken within a quarter of an inch of it, but, as Mr. Martin writes, "Luckily he only escaped 'Charybdis to fall into Scylla,' for I incontinently pulverized him."

ADDITIONAL NOTE ON CERATITIS CAPITATA.

In our brief review of the literature of this interesting insect in our article in the last number, entitled "A Peach Pest in Bermuda," we neglected to mention a most important article which is contained in Dr. O. Penzig's "Studi Botanici Sugli Agrumi e Sulle Piante Affini," published in the "Annali di Agricoltura" for 1887. Dr. Penzig reviews the general subject of Dipterous insects on the Orange and gives an account of the literature of the three species of *Ceratitis*, viz, *C. capitata*, *C. catoirei*, and *C. hispanica*, all of which he treats under the generic name of *Halterophora*, proposed by Rondani on account of the preoccupation of *Ceratitis* in Ammonites.

C. catoirei comes from the island of Bourbon and from Mauritius; *C. capitata* from the East Indies and the Azores Islands, while *C. hispanica* is found in the Mediterranean region and differs from the other two, which Doctor Penzig thinks may be synonyms, by the possession of two frontal tubercles. He gives a good account of the different stages of the latter species and also an account of its life history from which it appears that the perfect insect is possessed of extraordinary vivacity and lives by sucking the sweets of different fruits, oranges, peaches and figs, which the fly is not able to pierce with its mouth parts, but only sucks when they are injured from other causes.

The female penetrates the skin of a half-grown orange and lays her eggs at a depth of from one to three millimeters. In a few days the larvæ hatch and burrow through the skin and into the pulp of the fruit, rendering injured fruit readily recognizable by a brown or olive spot which soon extends to from three to five centimeters in diameter. The original puncture is always noticeable and the larva returns to it frequently for air, placing its anal spiracles against the opening. The orange soon falls to the ground and in the space of fifteen days, more or less, the larvæ issue, either through the original opening, or through another one made for the purpose, and enter the ground, where they transform to pupæ, remaining in this condition only a few days. There are presumably a number of annual generations. The orange is preferred for food, but lemons and other cultivated citrus fruits are also attacked, as well as peaches, figs, azaroles, etc. The species seems to be limited to the countries around the Mediterranean. Found originally in Spain, it was soon discovered to do great damage in Algeria. In Sicily it was first confined to oranges but later attacked peaches

and other fruits. In Liguria it was occasionally observed in 1882 damaging peaches, but seemed to leave citrus fruits intact; at least the author was not able to verify its presence in oranges or lemons.

As a remedy it is proposed to collect and destroy the infested fruit or to submerge it for a short space of time in water.

As a means of destroying the infested fruit he proposes to place it in a ditch, covering with a layer of caustic lime, thus after six months converting the entire mass into a valuable fertilizer. Concert of action and energetic measures on the part of the provincial authorities are urged.

PROCEEDINGS OF THE ENTOMOLOGICAL CLUB OF THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE, INDIANAPOLIS, 1890.

The club met in regular session on August 20, 9 a. m., in room 11, in the State House, President, Prof. A. J. Cook, in the chair. There were present through the meeting, Messrs. Chas. Robertson, Clarence M. Weed, E. W. Claypole, James Troop, F. S. Earle, L. H. Pammel, Herbert Osborn, John Marten, H. Garman, Geo. F. Atkinson, Chas. W. Hargitt, Thos. Hunt, John W. Spencer, W. B. Alwood, J. Fletcher, F. M. Webster, W. W. Norman, S. G. Evans, W. S. Blachley, Truman P. Carter, Ralph St. F. Perry, Miss Mary E. Murtfeldt, Miss Augusta Murtfeldt, Mrs. K. B. Claypole, Mrs. O. Hanney.

The president proceeded to deliver a most interesting address upon Teaching of Entomology.

Dr. C. M. Weed, speaking with reference to the president's address, urged the study of French and German, as a knowledge of those languages was almost essential when making a thorough study of many species of insects. He also criticised Professor Cook's plan of labeling specimens, as requiring too much labor.

Prof. Herbert Osborn highly commended the course of instruction laid down by the president in his address.

Dr. C. M. Weed then read a paper upon the life history of the Evening Primrose Curculio (*Tyloderma foveolatum*). He reported breeding a species of *Bracon* from the larvæ of the Curculio; and recorded observations upon the habits of both insects. All of Dr. Weed's papers will appear in a forthcoming Bulletin of the Ohio Experiment Station.

Mr. F. M. Webster had heard Dr. Weed's paper with interest, and was pleased that he had made further observations upon this interesting insect.

The meeting adjourned to meet again at 5 p. m.

The club met at 5 p. m. pursuant to adjournment. At the request of the president, Mr. Fletcher presented some notes upon the injuries caused by the Hessian Fly, the Wheat Stem-maggot, and an undetermined species of *Oscinis*. He stated that he had been studying these insects at Ottawa, Canada, during the last four years.

The note was presented with the object of eliciting further informa-

tion. He had been trying to ascertain, for the Ottawa district, the number of broods of Hessian Fly in a season. He had found that the Hessian Fly, the Wheat Stem-maggot and an *Oscinis*, were all found at the same time in the same plants, and further speaking, generally they passed through their stages contemporaneously. Of the three, the *Oscinis* had proved much the most destructive during the past summer. He had found spring wheat sown in April, badly attacked at the root by all three. With regard to the Hessian Fly, this was a new attack in his experience. The perfect insects of the Hessian Fly and *Oscinis* had emerged at the end of June, and a month later *Meromyza*. He had taken the adult Hessian Flies at Ottawa during the present season, in the beginning of May, at the end of June, and in August, and he supposed they would appear again in September. He had not been able to find the Hessian Fly breeding in any of the grasses, and would like to know if others had done so. *Meromyza* and the *Oscinis* were both most destructive pests in grass lands. Both of these had been present in the perfect state during the past spring in enormous numbers, but notwithstanding this, the conspicuous summer attack of *Meromyza*, causing "silver top" in wheat and barley, was less noticeable than usual. He could only account for this by supposing that the eggs had been destroyed, as the amount of injury to the root shoots was only about the same as usual.

The *Oscinis* he had been unable to identify; but Mr. John Marten had told him during the present meeting of a similar attack which had been studied by Professor Garman, in Kentucky, which appeared to be of the same species. This had been identified by Dr. Williston as probably being *Oscinis variabilis*. Professor Cook stated that at Lansing, Mich., *Meromyza* was one of the worst pests in oats. He had seen no notice of this attack in literature on the subject. They had looked carefully for Hessian Fly in grasses; but so far had not succeeded in finding it.

Mr. Garman stated that he had studied what appeared to be the same species of *Oscinis*, in Kentucky, and had prepared there an article for publication.

Professor Osborn stated that he had taken at Ames, Iowa, numerous specimens of *Oscinis*, one of which closely resembled that exhibited by Mr. Fletcher. Mr. W. B. Alwood mentioned having studied, in Ohio, a species of *Oscinis* infesting oats, and had published his results in Bulletin 13, Division of Entomology. He had found that the eggs, two to eleven in number, were forced between the sheath slightly below the juncture of the leaf, and that, just prior to pupation, the larvæ gnawed through the epidermis and the pupæ protruded so as to admit of the easy escape of the adult.

Mr. Fletcher, referring again to the *Meromyza*, stated that in many instances he had found the egg deposited upon the upper surface of the leaf, some distance from the stem, and asked if others had observed this to be the case elsewhere.

Mr. Garman had found that the eggs were laid just above the sheath, or sometimes pushed beneath it.

Mr. Webster stated that the eggs of Hessian Fly had, the past spring, throughout the southern and central parts of Indiana, been deposited near the roots, the flaxseeds being found in that portion of the plant, while in the northern part of the State the case had evidently been different, as the flaxseeds were there almost invariably located several inches up the stem, near the second joint.

A paper on the subject of American silk spinners by Mr. Edward L. Graef was read by the Secretary, of which the following is an abstract.

Refers to the periodical, phenomenal increase of some species of insects and their sudden disappearance. Speaks of the adaptability of the cocoons of *L. cecropia* Linn. for the manufacture of silk, and of the firm belief of the writer in the possibility of the creation of an American industry in the rearing of the larvæ for manufacturing purposes. Solicits plans for the profitable rearing of the larvæ of this, or other American silk spinners, also for preparing their cocoons for this purpose. Offers a prize (\$50.00) for this purpose.

THURSDAY, August 21.

Club opened its morning session at 8.00 a. m. by an interesting paper by Dr. C. M. Weed, the subject of which was "The Food Plants of the clover Stem Borer" *Languria mozardi*. Fifteen species of the plants were reported on which the larva is known to feed.

This paper was discussed by Professors Cook, Alwood, Osborn and others.

Professor Alwood announced his intention of studying tobacco insects, and mentioned having observed a stem borer. Dr. Weed had heard of a tobacco root-louse in southern Ohio.

Professor Osborn followed with a paper on a peculiar coleopterous larva infesting the stems of plants.*

Professor Garman spoke of the mouth parts of some of the *Thysanoptera*, and stated that some recent studies of mouth parts, had fully coincided with previous studies of his in the same direction. In all material examined he had found the mouth parts unsymmetrical.

Dr. Weed presented a short paper upon the oviposition of *Listronotus latiusculus*. The eggs are laid in bunches of five to ten on the leaf stalks of *Sagittaria variabilis*, and are covered with bits of epidermis chewed up by the adult beetle.

This was discussed by Messrs. Garman, Fletcher and Webster.

Mr. Charles Robertson made some remarks upon the habits of *Emphor bombiliformis*, which he stated was apparently a special visitor of *Hibiscus*. The nests were constructed by burrowing in the ground, and, in order to facilitate the excavation, water was frequently carried to the

* To be published in INSECT LIFE.

† Mouth parts of the *Thysanoptera*, by H. Garman. Bull. Essex Institute, Vol. XXII, Nos. 1-3, 1890.

hole with which the bottom was moistened. Sometimes but one pellet of earth would be carried out after an application of water, while in some cases he had observed as many as four of these pellets thrown out immediately following an application. Discussion followed which was participated in by Messrs. Fletcher, Osborn, Cook, Weed, and others.

Miss Mary E. Murtfeldt read a charming paper entitled, "Some Experiences in Rearing Insects." In this paper some valuable hints were given as to the best way to manage larvæ so as to carry them to maturity, and the most frequent causes of failure were mentioned. The paper was listened to with great attention by all present.

Mr. Fletcher spoke in terms of high approval of the paper, which he said bore upon its face the mark of being the production of a worker, one who had seen and knew the things she spoke of. He then gave a short account of some of his own failures and successes in breeding larvæ from the egg.

Mr. Webster also spoke in the same strain; he had not previously had the pleasure of meeting Miss Murtfeldt, but he hoped she would be a frequent attendant at future meetings of the club. Professor Osborn had listened with pleasure to Miss Murtfeldt's experience; he had always found that the simpler the apparatus the better. For small larvæ he used glass tubes having the ends closed with cotton wool.

Club convened at 5 p. m. and proceeded to consider the following resolution:

Resolved, That it is the sense of the club that the meetings of the Association of Official Economic Entomologists and of the Entomological Club would both be benefited by holding such meetings, if possible, at the same time and place as the meeting of the American Association for the Advancement of Science.

After discussion by Professors Fletcher, Osborn, Cook, Alwood, Weed, and others, the resolution was unanimously adopted.

The secretary proceeded to read the following paper upon "The Preparatory Stages of *Eustrotia caduca*," by D. S. Kellicott, of Columbus, Ohio.

This was discussed by Messrs. Weed, Webster and others.

Professor Cook presented a note upon a new breeding habit in *Agrotis C-nigrum*. He had found the eggs on the foliage of currant bushes and had reared the larvæ thereon.

Professor Osborn read an interesting paper on the period of incubation of *Mallophaga*.*

Mr. F. S. Earle presented several interesting notes on some injurious insects of southern Mississippi. *Diabrotica 12-punctata* was a very abundant insect, and, in addition to its well-known food plants it also fed to an injurious extent upon the foliage of peach and also cabbage. Cut-worms were very injurious in gardens. A species of *Aphis* worked serious injury to the cucumber and melon vines. *Pieris rapæ* is exceedingly destructive. *Doryphora 10-lineata* had not yet reached

* To be published in INSECT LIFE.

southern Mississippi. Sphinx larvæ were very destructive to the foliage of tomatoes and the Boll-worm to the fruit.

Club met at 8.30 a. m., 22d.

Dr. Weed presented a short paper on the habits of *Lixus concavus*. Discussed by Cook, Fletcher, and Webster.

Professor Hargitt called attention to early observations on the Canker Worm.*

Professor Hargitt also spoke of a Cecidomyia infesting the tops of Solidago, and also presented some notes upon *Cermatia forceps*.

This myriopod has, within the past two or three years, become quite numerous in houses and college buildings at Oxford, Ohio. The difficulties mentioned by Dr. Lintner in the fourth New York report, and by others, of keeping the specimens in captivity, he found to be very general. He succeeded in keeping them for several days in captivity, and inducing them to take prey by keeping them in dark quarters during the day. It took and devoured various insects, such as the croton bug, mentioned by several observers, and the common house fly.

Mr. Webster spoke of the predaceous habits of *Cermatia* and its preying upon the croton bug. Mr. Fletcher had observed the insect with Mr. Howard, at Washington. Its mode of capturing the croton bug before devouring it was remarkable. It sprang over its prey which was thus engaged between many curved legs. He thought that Mr. Hargitt's success in keeping alive the specimens he had confined in a tin canister was more due to the moisture thus secured than the darkness. He understood that this insect was a lover of damp places, like many other myriopods.

The club then proceeded to the election of officers for the ensuing year, which resulted as follows:

President, Prof. Herbert Osborn, Ames, Iowa.

Vice-President, Miss Mary E. Murtfeldt, Kirkwood, Mo.

Secretary, Clarence M. Weed, Columbus, Ohio.

Professor Osborn presented a paper on "The Use of Contagious Diseases in Destroying Injurious Insects."†

Mr. Fletcher thought it difficult to keep diseases over winter and to have them in the right condition when wanted.

Professor Hargitt reported disease in the Canker Worm.

Professor Cook thought the greatest argument against the use of disease was the resistance against them.

Professor Garman thought *Empusa* very difficult to introduce, much more so than Bacteria. He doubted the practicability of infecting the Boll-worm with the disease of the Cabbage Worm. This would probably be better accomplished on the Tent Caterpillar.

Adjourned to meet at 12 m.

* Published in INSECT LIFE, Vol. III, p. 8, 1890.

† To be published in INSECT LIFE.

Club reassembled at 12 m. 22d.

Professor Atkinson spoke of some insects of Alabama. The Bud worm, as it is called, though it is probably the larva of *Diabrotica 12-punctata*, is very abundant, working in young corn.

Plusia brassicae is very abundant. In the southern part of the State it has done more injury to cabbage than *Pieris*. Also attacks the potato. *Pieris protodice* does not occur in any great abundance in the southern part of the State. The melon worm destroys 50 per cent. of the melons in some sections. These may be destroyed by Paris green, and later by kerosene emulsion. *Scolytus rugulosus* occurred in the Station orchard. Thrips are very injurious to grain, and also infest the cotton plant.

Professor Cook said that Thrips were very abundant on grain in Michigan. Mr. Webster said that *Scolytus rugulosus* had occurred this season in Indiana but he had not found them capable of injuring a healthy tree, only such as had suffered from diseased roots or a girdled trunk were seriously attacked. Mr. Fletcher stated that Canadian lumbermen told him that borers only attacked trees with "sour sap." Mr. Webster said that while he believed this to be true of *S. rugulosus*, *Xyleborus fuscatus*, in June, attacked logs of both cypress and cottonwood, while in the rafts in the St. Francis River, Arkansas, and did serious injury by boring into the solid wood. Professor Atkinson stated that a lepidopterous larva attacked the living oaks in Alabama. Miss Murtfeldt thought that this season the early brood of *Pieris rapæ* had been destroyed by the winter.

Dr. Weed read a short paper on the oviposition of *Dectes spinosus* in *Ambrosia trifida*.

Mr. Webster stated that he had usually found the species on or about *A. artemisiæfolia*.

Professor Cook presented some notes on the insects of the year. He said that Cut-worms and Saw-flies had been very injurious. The larvæ of *Egeria tipuliformis* was attacked by a fungous growth like that attacking the White Grub. The foliage of the quince and cherry were injured by the first brood of larvæ of Cherry Slug. Road dust was applied with excellent results.

Dr. Weed presented a short paper on *Psephenus lecontei*, which, he stated, he had found on the shores of Lake Erie.

Mr. Webster stated that he had taken what, without critical study he supposed to be this species, on the shores of Chautauqua Lake, New York.

Club adjourned to meet in connection with the A. A. A. S. next year.

F. M. WEBSTER,

Secretary.

NOTICE OF MEETING OF THE ASSOCIATION OF OFFICIAL ECONOMIC ENTOMOLOGISTS.

The second annual meeting of the Association of Official Economic Entomologists will be held at the University buildings, Champaign, Ill., November 11 to 15 proximo, at the same time as the meeting of the Association of Agricultural Colleges and Experiment Stations. The Committee on Entomology of the latter Association will meet at the same time.

Members expecting to attend will confer a favor upon the officers if they will announce the fact, and will send titles of papers to be read or topics they desire discussed, to the secretary.

All are earnestly urged to be present, if possible.

JOHN B. SMITH,
Secretary, New Brunswick, N. J.

THE ENTOMOLOGICAL SOCIETY OF WASHINGTON.

September 4, 1890.—Under the head "short communications and exhibition of specimens," Mr. Heidemann spoke of the occurrence of *Cylapus tenuicornis* (Capsidæ) near Washington, D. C., and Mr. Schwarz exhibited specimens of *Choragus nitens* (Anthribidæ) lately found in the District, also a branch of *Carpinus* infested in a peculiar way by the larvæ of *Acoptus suturalis* (Curculionidæ), and a specimen of *Hymenareys nervosa* with deformed antennæ, and he also called attention to the reported discovery of the stylopized *Gryllotalpas* in eastern Africa. Dr. Marx reported having found specimens of *Latrodectus* under a board, devouring carabids—the webs of the spider being garnished with fragments of the beetles. As possibly throwing light on the subject, Professor Riley mentioned having been greatly surprised this summer at the large number of insects, *Lachnosterna*, *Xylocopa*, *Bombus*, etc., that he found about his grounds at Sunbury, with large perforations and apparently killed by birds, and probably the house wren. Mr. Fox thought that spiders were largely responsible for this work. Professor Riley described his recent investigations into the life-history and habits of *Sphecius speciosus*, exhibiting specimens of the egg *in situ* on Cicadas, and of the young and full-grown larvæ and cocoons. Careful drawings were shown illustrating the different stages and habits of *Sphecius*.

Mr. Schwarz queried, in view of the earlier appearance of the *C. septendecim*, whether *Sphecius* ever preyed on that species. Professor Riley showed that the period of *septendecim* and *Sphecius* overlapped, and that the general belief that *Sphecius* attacked the seventeen-year locust, while not based, so far as he recalled, on observation, was probably well founded.

Mr. Howard exhibited specimens of sand cricket, *Stenopelmatus fasciatus*, which had been recently sent to Professor Riley by one of his correspondents. Mr. Howard stated that they occurred abundantly in the Southwest, and are reported erroneously to be extremely poisonous. As stated by Professor Riley in the Standard Natural History, they are carnivorous in habit.

Mr. Mann described some observations and experiments relating to the longevity of decapitated specimens of *Caloptenus* and the vigorous resistance of such specimens to the attacks of ants.

Mr. Schwarz, "On Black Locust Insects," presented a list of twenty-four species of Coleoptera bred by him in May from dying trunks of Black Locust, and spoke of the principal insect enemies of this tree in the District. Discussed by Messrs. Riley and Howard.

Mr. Schwarz also read a paper on the food habits of some Scolytidæ observed by him during the summer. Galleries of the following species were exhibited and explained: *Xyloterus politus* in *Acer dasycarpum*; *Xyleborus furcatus* and *pubercus* in Walnut; *Cnesinus strigicollis* in *Liquidambar styraciflua*.

C. L. MARLATT,
Recording Secretary.

SPECIAL NOTES.

Name of the Oyster-shell Bark-louse of the Apple.—Mr. Albert C. F. Morgan has been bringing together some very interesting bibliographic notes concerning scale-insects and has been publishing from time to time in the *Entomologists' Monthly Magazine* for the past year or two. His comments upon the insect which we have learned to know as *Mytilaspis pomorum* Bouché, are given in the August, 1890, number of this journal and are worthy of comment. Mr. Morgan, from a comparison of descriptions, has lumped many names as synonyms of Modeer's *Coccus linearis*. Among them is our common apple species. He brings forth many facts in support of his views, but we would protest against the adoption of the name *Mytilaspis linearis* for this species. In the first place, as Mr. Morgan himself must be aware, all arguing from the mere descriptions of *Diaspinæ*, particularly those of the genus *Mytilaspis*, which were drawn up without reference to characters of the anal plate, must be based upon extremely problematical and uncertain grounds. There is absolutely no way in which we can be certain that Curtis's *Aspidiotus conchiformis*, Fitch's *Aspidiotus juglandis*, and Schrank's *Coccus pincti*, for example, are one and the same species, without securing the actual specimens which these authors had before them at the time when their descriptions were drawn up, mounting them carefully and making careful studies of the anal plate, and, if possible, of the males. We were perfectly willing to adopt Professor Comstock's carefully worked out dictum to the effect that *Mytilaspis pomicorticis* Riley is a synonym of Bouché's *pomorum* in spite of the not thoroughly well explained differences in the color of the eggs and the other reasons given in the fifth report on the insects of Missouri; but now that for ten years entomologists have generally treated of this Apple scale as *M. pomorum*, it is too much to expect that, simply from Mr. Morgan's comparisons of the descriptions, this name should be dropped in favor of *linearis*. The uncertainty and insufficiency of the proof renders the change very undesirable.

The second Edition of Miss Ormerod's Manual of injurious Insects.*—This greatly enlarged and revised edition of Miss Ormerod's valuable handbook has just reached us, and, on account of its convenient size, admirable arrangement, plain language, and abundant illustrations, it is almost a model of what such a work should be. It does not contain much matter which is new, but since Miss Ormerod has drawn very largely from her own well-known reports her name should certainly appear on the title-page as *author*, and not under the modest title of *compiler*. Our space prevents an extended review of this admirable volume, although we find much in it of interest to the American entomologist and agriculturist, since so many of the insects treated are common to both England and America, while there is hardly a species mentioned which is not liable at almost any time to make its appearance in America, judging from the frequent accidental importations of late years. The work comprises, Part I, Food Crops and the Insects Injurious to Them; Part II, Forest Trees and Insects that Injure Them; Part III, Fruit Crops and Insects that Injure Them; an alphabetical list of insects treated; an introduction to entomology, couched in very popular language and giving an idea of the classification; and a glossary of entomological terms followed by a full index. The work covers 410 pages and has an illustration for almost every second page. Miss Ormerod's work can not be too highly commended.

The cheapest Form of Light.†—Under this taking title Professor Langley and his assistant, Mr. Very, have published the results of their recent researches upon the so-called phosphorescent light of certain insects, in the same form in which they were presented at the last meeting of the National Academy of Sciences. The insect principally used in the experiments was the large Cuban Fire-fly (*Pyrophorus noctilucus*). We assisted Professor Langley in the spring and summer of 1889 in importing a number of these insects from Cuba with the help of Professor Poey of Havana, and Señor Bonzon of Santiago de Cuba, and, after many failures, succeeded in getting a large number of healthy living specimens, upon which photometric and thermal observations were made at the Allegheny Observatory. The total radiant heat from the light of one of these insects (heat representing waste) was compared with that transmitted by glass from the nearly non-luminous Bunsen flame, the luminosity from which was very much fainter than that from the insect. The most accurate observations prove that the insect light

* A Manual of Injurious Insects with Methods of Prevention and Remedy for their attacks to Food Crops, Forest Trees, and Fruit. To which is appended a short Introduction to Entomology. Compiled by Eleanor A. Ormerod, F. R. Met. Soc., etc., London: Simpkin, Marshall, Hamilton, Kent & Co., 1890.

† On the Cheapest Form of Light, from studies at the Allegheny Observatory by S. P. Langley and F. W. Very. Authors' extras from the American Journal of Science, Vol. XL, August, 1890.

is accompanied by approximately one four-hundredth part of the heat which is ordinarily associated with the radiation of flames of the luminous quality of those experimented with. Thus Nature produces this cheapest light at about one four-hundredth part of the cost of the energy which is expended in the candle-flame, and at but an insignificant fraction of the cost of the electric light which is the most economic light which has yet been devised. "Finally," the author concludes, "there seems to be no reason why we are forbidden to hope that we may yet discover a method (since such a one certainly exists and is in use on a small scale) of obtaining an enormously greater result than we now do from our present ordinary means for producing light."

Dr. Curtice on the Animal Parasites of Sheep.—This Department has recently issued a valuable Treatise on the Animal Parasites of Sheep by Dr. Cooper Curtice, of the Bureau of Animal Industry. The work is interesting from an entomological stand-point from the careful studies which it contains of the following insects, of which the first-named is perhaps the most important of all the ovine parasites: The Sheep Gad-fly (*Æstrus ovis* Linn.); the Sheep Tick or Louse-fly (*Melophagus ovinus* Linn.); the Sheep Louse (*Trichodectes sphaerocephalus* Nitzsch.); Goat-lice (*Trichodectes limbatus* Gervais and *T. climax* Nitzsch.). Though not true insects, the *Acari* or Itch or Scab Insects or Mites, of which three species are treated, may also be considered as belonging to the domain of the entomologist. The species parasitic on sheep are *Sarcoptes scabiei* DeG. var. *ovis*, which causes the scab of the head; *Psoroptes communis* Fürst. var. *ovis*, which causes the common scab; and *Chorioptes communis* Verh. var. *ovis*, which causes the foot-scab.

Some forty-four pages and eight plates are devoted to the parasites named. The illustrations are excellent and very accurate, and represent, as far as possible, the life-history of the species. The three plates devoted to *Æ. bovis* are especially interesting and particularly Plates II and III which represent sections of the head of a sheep with the Gad-fly larvæ in situ in the sinuses and cavities. Through the courtesy of Dr. Curtice we had the opportunity of examining the specimens from which these latter plates were drawn and can vouch for their accuracy. Plate I, however, is more or less inaccurate in its delineation of the adult of *Æstrus ovis*.

The work deals at length, also, with the various intestinal and lung parasites of the sheep and will be of great practical value both to the sheep raisers and to veterinarians.

Notes on Plant-Lice.—Bulletin, Technical Series, Vol. I, No. 2, Article V, of the Ohio Agricultural Experiment Station contains the fourth of Dr. Clarence M. Weed's papers entitled "Contributions to a Knowledge of the Life-history of certain Little-known Plant-lice (*Aphididæ*)."

The paper comprises more or less complete notes on the habits and careful descriptions of various stages of the Cherry Plant-louse (*Myzus cerasi* L.), Willow Grove Plant-louse (*Melanoxanthus salicti* Harr.), Spotted Willow Plant-louse (*Melanoxanthus salicis* L.), White Pine Plant-louse (*Lachnus strobus* Fitch), Toothed Willow Plant louse (*Lachnus dentatus* Le B.), and the Scotch Pine Plant-louse (*Lachnus pini* L.).

Four plates of drawings by Miss Freda Detmers, Mr. Weed's assistant, accompany the article and illustrate several of the stages of the plant-lice discussed. All publication on Aphidids that does not embrace the full annual life-cycle must needs be preliminary; but such studies as the above are most useful as helping to final results.

The Boll Worm Investigation.—By resolution of Congress the Division has been instructed to conduct an investigation upon the Cotton Boll-worm (*Heliothis armigera*) supplementary to that which was summarized in the Fourth Report of the U. S. Entomological Commission. Active measures have been taken to make a success of the investigation and trained agents have been stationed at Holly Springs, Miss., College Station, Tex., Pine Bluff, Ark., and Shreveport, La., and are carrying on a course of observations and experiments.

Diseases of Crops and their Remedies.*—Dr. O. B. Griffiths has recently favored us with a copy of his little book with the foregoing title, which forms one of the Bell's (London) Agricultural Series, and is designed, as stated on the title page, as a hand-book of economic biology for farmers and students. It gives briefly the life-histories of the principal insect and vegetable foes of the farm together with means to prevent or reduce the losses arising therefrom, and will doubtless be of service to the English farmers. The subject matter of the book has been compiled from various sources including, on insects, the publications of the U. S. Entomologist. The illustrations are copious and apparently new, but of very inferior character.

SOME NEW ICERYAS.

It is a peculiar and interesting fact that while, since 1878, the genus *Icerya* has been known only by its two species *I. seychellarum* (Westw.) (= *sacchari* Sign.) and *I. purchasi* Mask., the present season should have brought to light no less than four additional species. The enormous damage done by *I. purchasi* in South Africa, New Zealand, and particularly in California, bids fair to be duplicated by that which has been and may be done by the new *I. ægyptiacum* (Doug.) in Egypt, while the probabilities are that much damage may be expected from

* London: George Bell & Sons, 1890, 2s. 6d.

the three new species which we shall here characterize. The importance of the matter therefore demands that the species shall be immediately described, albeit from rather insufficient material, and all known facts at once placed on record.

THE ROSE ICERYA.

(*Icerya rosæ* Riley and Howard.)

On page 333 of Vol. II of INSECT LIFE (No. 10, April, 1890) we published a short note on this insect, describing briefly the stages which we possessed and giving it the MS. name of *Icerya rosæ*, deferring detailed description on account of insufficient material. All the specimens which we have received have been sent to the Department by Passed Assistant Paymaster H. R. Smith, U. S. Navy, from Key West, Fla.

The original specimens were sent March 24, 1890, on a limb of rose, with the information that the rose propagators on the Key were greatly troubled by the pest, which causes the limbs to dry and the leaves to fall. The

second sending was received in April, and Mr. Smith stated in his accompanying letter that, while the rose-bushes in the yard from which he took the specimens sent had been infested only four or five months, he was told that other plants, including the Sugar-apple, Lime, and Lemon, had been visited by it for years. The weather had been unusually dry for four or five months and the owner of the bushes was of the opinion that the insect did not appear until the drought set in.

An examination of the specimens received shows that they preferably infest the stems at and near the forks, and the leaves along the midrib on the under side (Fig. 6).

We have called this insect the Rose Icerya, for the reasons that it was sent to us as a Rose pest, that we have seen it on no other plant, and that Mr. Smith's informants were possibly in error in their statements as to its infesting other plants, as several other scale insects, not readily distinguishable from this to the untrained eye, are commonly found in Florida on the plants mentioned. In other words, the only plant which we know it to infest is the Rose.



FIG. 6.—Rose twig infested by *Icerya rosæ*, natural size (original).

The following full descriptions of the stages at hand include and are supplementary to the few diagnostic characters given in connection with our first announcement. They should be compared with the full descriptions of *I. purchasi* in the report of the Entomologist, Annual Report U. S. Department of Agriculture for 1886, pp. 475-481.

***Icerya rosæ* Riley and Howard.**

THE EGG (Fig. 7, b).—The egg is ovoid, smooth, yellowish-red in color, and 0.5mm in length.

NEWLY-HATCHED LARVA (Fig. 7, a).—General color, dull red; eyes, antennæ, legs, and hairs dark brown, nearly black, becoming gradually much lighter after prolonged immersion in balsam; apex or cornea of the eyes, dark red. Eyes large, projecting, conical. Antennæ, six-jointed; joint 1 very stout, narrowest at tip, inner side very convex; joints 2, 3, and 4 subequal in length; joint 5 shorter, all subcylindrical; joint 6 club-shaped, a little longer than 3 and 4 together; joints 1 to 5 each bear a pair of

FIG. 7.—*Icerya rosæ*: a, newly hatched larva; b, egg—greatly enlarged (original).

long, fine hairs, becoming successively longer and stouter; joint 6 bears six very long, stout hairs, each longer than the entire antenna, and each arising from a distinct tubercle, and about six shorter hairs, one or two of which are sometimes quite long. Body oval, broadest across the mesothorax; sparsely covered with short black hairs, more numerous and longer on the three last joints. The whole lateral margin is fringed with very long hairs, each arising from a tubercle, those at margins of abdomen differentiated from the others by superior size and length and greater size of tubercle. There are nine on each side of abdomen, the three anal ones precisely resembling those found in the corresponding stage of *I. purchasi*. The six anterior ones have a characteristic forward arch, and their tubercles are abruptly bent forward. The three anal bristles are longer than the others, but all nine seem to increase slightly in length toward the end of the body, the anal ones exceeding the body in length. The legs, tarsal digitules, secretory pores, and mouth parts are as in *I. purchasi*.

FEMALE LARVA—Second Stage (Fig. 8).—Stouter, more rounded and more convex than first stage. Color red, brownish in center, legs, antennæ and hairs dark brown, nearly black. Antennæ almost precisely like those of second stage of *I. purchasi*; they are relatively much shorter than in the newly-hatched larva; joint 1 short and stout, as broad as long; joint 2 as long as 1 but not quite so wide; 3 as wide as 2 and twice as long; 1, 2, and 3 subcylindrical; 4 and 5 short, rounded, each shorter than 2; joint 6 large, as long as 2 and 3 together, irregularly ovate in shape with a slight concavity on the outside; hairs much shorter than in first stage. The long bristles around the margin of the body are proportionately shorter, those of the thorax quite as long and stout as those of the abdomen, the abdominal ones having also lost something of the pronounced upward arch. The ones toward the anal end, instead of being longer than the entire body, as in the first stage, are about one-third the length of the body. The hairs on the back are still sparse, but the secretory pores are scattered. The legs are proportionately shorter.

FEMALE LARVA—Third Stage (Figs. 9 and 10 g and h).—In this stage the insect closely resembles *I. purchasi*. It is redder in color and not so hairy, but the antennæ are identical, and it possesses the other



FIG. 8.—*Icerya rosae*: c, larva, second stage—greatly enlarged; d, antenna of same—still more enlarged (original).



FIG. 9.—*Icerya rosae*: e, larva, third stage—greatly enlarged; f, antenna of same—still more enlarged (original).

characters, except that the secretory pores are sparser and it does not bear the cylindrical lipped pores from which extrude the glassy filaments which become so prominent in this stage of *I. purchasi*. The shape is broadly elliptical, moderately convex. Antennæ nine-jointed; joints 4 to 8 subequal in length and nearly as broad as long; 2 and 3 broader and considerably longer; 9 as long as 7 and 8, together but not broader. The lateral hairs are as in the previous stage, but relatively shorter, and many other lateral hairs have grown out to an equal length. The white, waxy secretion is dense and completely covers the body, the black hairs projecting through it and forming a fringe around the body. The secretion first makes its appearance in tufts, as with the larvæ of *Ceroplastes*, and at a certain stage of growth after the second molt will be noticed a median row of five or six tufts, a subdorsal row of four, and a lateral row of one to each lateral segment of abdomen. In molting the skin splits down the back of the head and thorax and the adult slowly crawls

through this orifice. A very great number of the wax-covered skins of this stage occur on the rose twigs and leaves sent us.

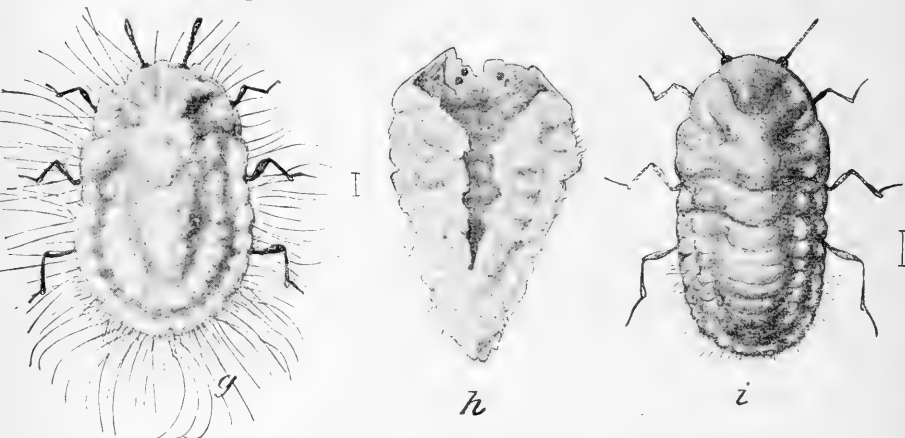


FIG. 10.—*Icerya rosae*: *g*, larva, third stage, with waxy covering; *h*, same, cast skin; *i*, adult, immediately after molt—greatly enlarged (original).

ADULT FEMALE—Fourth Stage (Figs. 10*i*, and 11).—Similar in size to adults of *I. purchasi*, broadly oval in shape and densely covered with a short powdery secretion

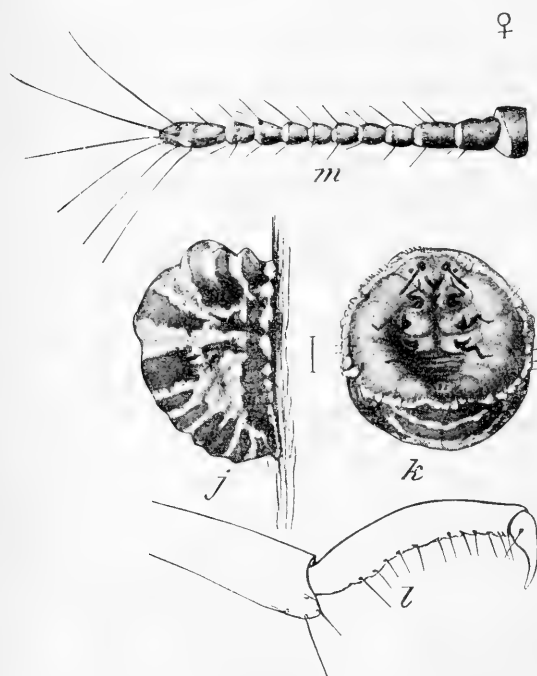


FIG. 11.—*Icerya rosae*: *j*, pregnant ♀, side view; *k*, same, ventral view—enlarged; *l*, tarsus of same; *m*, antenna of same—still more enlarged (original).

which forms a series of short close plaits around the margin. The waxy secretion has often a yellowish tinge. No distinctive egg-sac was to be found with any of the specimens received, and it is probable that such is not formed. Removing the secretion, the head and thorax are black, margined with red, while the dorsum of the abdomen and entire under side of the body are bright red; antennæ, legs, and eyes black. Surface of the body covered with short hairs, lateral margin with longer hairs, still longer near anal end. Divisions of segments plainly marked, especially of abdomen, which has a broad rounded subdorsal ridge. On first issuing from the third stage the adult is only moderately convex, but advanced specimens are much swollen and appear more naked. The antennæ are like those of *I. purchasi*.

MALE LARVA—Third Stage (Fig. 12, *n* and *p*).—The male larva has been recognized only in this stage. It corresponds almost exactly with that of *I. purchasi*, having an elongate form, no mouth parts, sparse pubescence and secretion and nine-jointed antennæ.

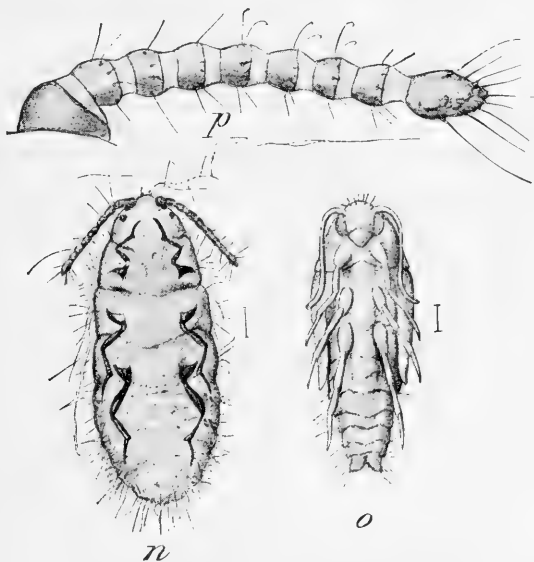


Fig. 12.—*Icerya rosæ*: *n*, male larva, third stage; *o*, male pupa—enlarged; *p*, antenna of *n*—still more enlarged (original).

MALE PUPA. (Fig. 12, *o*.)—A single male pupa was found. It agrees closely with that of *I. purchasi* except that the coxæ are elongate-ovoid instead of rotund and the anal segment shows a terminal cleft rather than a crescent cut.

THE EGYPTIAN ICERYA.

(*Icerya ægyptiacum*, Douglas)

Crossotosoma ægyptiacum Douglas, *Entomologist's Monthly Magazine*, second series, Vol. I, 1890, pp. 79–81.

It will be remembered that in the double number of **INSECT LIFE** for January and February, 1890, p. 256 (Vol. II, Nos. 7 and 8), we mentioned under the heading “An Egyptian Mealy Bug” the receipt from Mr. D. Morris, of the Royal Kew Gardens, of a copy of a letter from Mr. R. W. Blunfield, of Alexandria, Egypt, giving an account of a scale insect which during the past four years has infested the gardens of Alexandria, killing all the trees and causing the greatest alarm. It was said to have first appeared upon the Banyan tree, soon spreading with marvelous rapidity to many other plants. The statement was made that “a breeze sends the cottony pests down in showers in all directions.”

Specimens were referred by Mr. Morris to Mr. J. W. Douglas, who in the *Entomologist's Monthly Magazine*, second series, Vol. I, pp. 79–81 (March, 1890), described it as *Crossotosoma* n. g. *ægyptiacum* n. sp.

A careful study of Mr. Douglas's full description and comparisons with *I. purchasi* and particularly with specimens of the new and still more

closely related species on *Chrysophyllum* from Montserrat, West Indies, which we treat next, have convinced us that this Egyptian species is in reality an *Icerya* and that therefore the new genus *Crossotosoma* is a synonym. Mr. Douglas has seen only the adult female and the newly hatched larvæ and gives as his generic diagnosis the following: "Antennæ of eleven joints. Eyes not faceted, oval, produced in the form of a subconical truncate tube. Rostrum present. Body surrounded with a marginal fringe of long opaque processes. Anal ring not present. Legs simple." Later in his paper he says: "In the larva

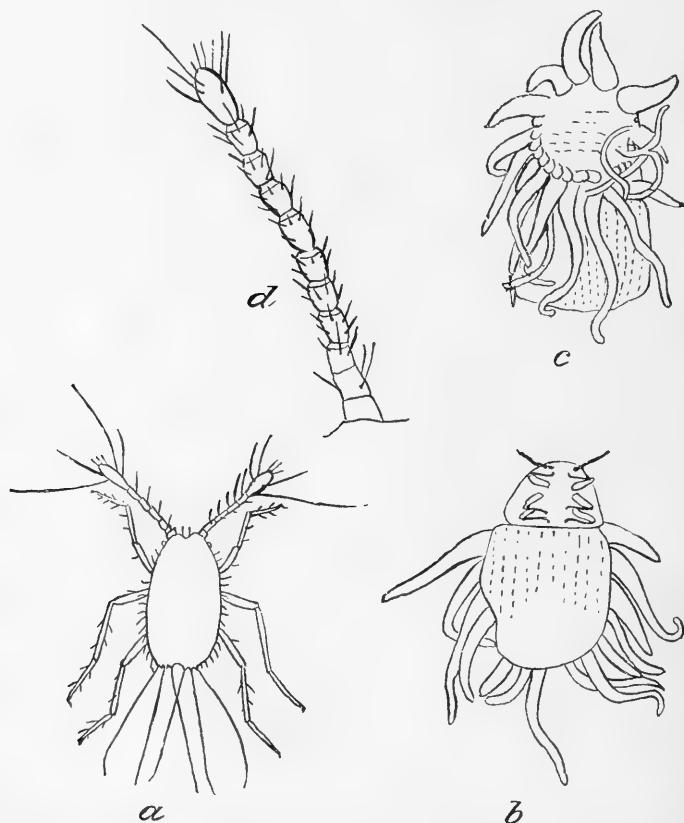


Fig. 13.—*Icerya aegyptiacum*: a, newly hatched larva; b, adult female form below; c, same form above—enlarged; d, antenna of same—still more enlarged. (After Douglas.)

with its six caudal setæ, and in the adult ♀ with eleven joints in the antennæ there are suggestions of the genus *Icerya*, but the form of the joints is different and most of the characters, notably the unique structure of the eye, are divergent, as also they are variously from the other genera of *Monophlebidae* of which *Guerinia* alone has similar subpyriform joints in the antennæ."

All of the points of difference which Mr. Douglas has indicated between his new genus and *Icerya* we are able with one exception to

readily reconcile with the aid of our very abundant material in the latter genus. The eye structure to which he gives such particular weight as a distinguishing character, is common to *I. purchasi*, *I. sacchari*, and *I. rosæ*. The proportions of the antennal joints are identical with those of *Icerya*, and the "subpyriform" appearance of joints 4 to 10 is one which is often perceptible in *I. purchasi*, and, in fact, is much as we have shown it at Fig. 3a of Plate II of our Annual Report for 1886. The single exception to the similarity of characters is the disposition of the waxy secretion, and this as it seems to us is a matter wholly of specific and not at all of generic importance. In Mr. Douglas's species the ovisac is of about the same relative size as that of *I. purchasi*, and of about the same shape. "It curves under the abdomen and completely covers the underside of it, closely attached thereto at the edges, forming a capacious receptacle, quite smooth externally, but with the faintest indication of longitudinal striæ." The most characteristic features of the secretion are described by Mr. Douglas as follows :

In the first stage of adulthood the whole smooth surface has a pellicle of white, waxen matter closely adherent, but easily detached, and often more or less easily rubbed off; eventually, as the ovisac is developed, exudation of waxen and cottony matter obscures the segmentation. At first there is a narrow, well-defined marginal rim all round the body, afterwards there is a flattened area exterior to this; from just below it, on each side of the abdomen, is a projecting fringe of seven to eight distinct, contiguous, stout, sinuate, tapering, waxen, snow-white, opaque, fragile processes, 3 to 5^{mm} long, much curved round at the pointed ends, all as a rule tending downwards. In one specimen sheltered within a curved leaf, a similar but thicker, straighter, obtuse, upturned, or horizontal appendage also proceeds from the sides of each of the thoracic segments, and two from the head; the latter close together, the others wide apart. This is the most perfect example, and I regard it as typical of the species; in the other specimens these appendages, which are very fragile, have been more or less broken off by the incidents of the position of the insects on loose leaves during transit.

We have thus given Mr. Douglas's exact description of the arrangement of the secretion for the purpose of comparing it with the next species which we shall consider, and we reproduce his figures for the same purpose. Reverting to Mr. Blunfield's statement that "a breeze sends the cottony pest down in all directions," it is at once evident that it is these fragile, waxy processes which are thus broken off and fall, and that the insects themselves are not so dislodged.

Pending the finding and comparison of the males, therefore, we shall be obliged to consider *Crossotosoma ægyptiacum* as a true *Icerya*, differing from *I. purchasi* chiefly in the possession of the long waxy processes.

THE MONTSERRAT ICERYA.

(*Icerya montserratensis* n. sp.)

Under date of May 10, 1890, we were written to by the Montserrat Company, of Birmingham, England, asking that specimens of *Vedalia cardinalis* be sent to the attorney of their company at Montserrat, West

Indies, for the purpose of exterminating a scale insect allied to *Icerya purchasi*, which had made its appearance upon their orchards of lime trees. We at once entered into correspondence with Mr. H. de C. Hamilton, the attorney in question, asking for specimens of the insect in order to ascertain its relationship to *I. purchasi* before securing the sending of the *Vedalia*, as experiments both in this country and New Zealand have shown us that the latter insect is probably confined strictly to *I. purchasi* for food. It will feed on no other scale insects which have been

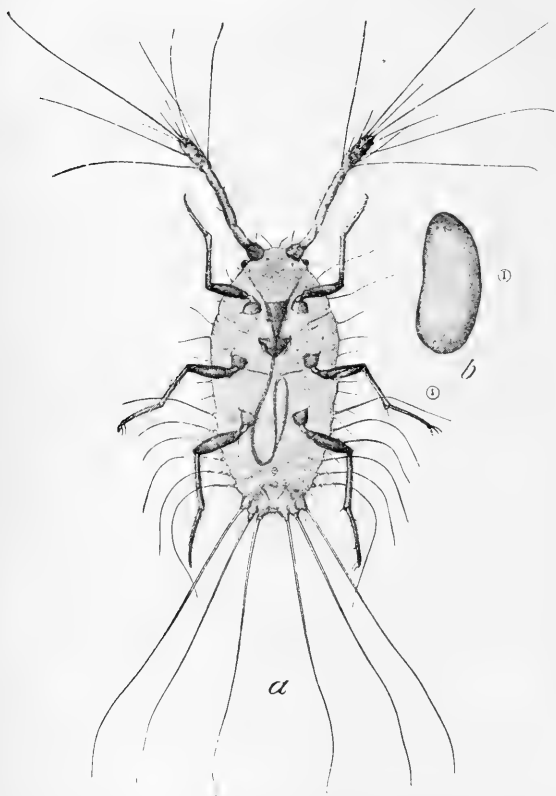


Fig. 14.—*Icerya montserratensis*: a, newly hatched larva; b, egg—greatly enlarged (original).

offered to it, although we have not been able to test it with other species of the same genus for the reason that *I. seychellarum*, the only other congeneric species known up to the present time, seems to be confined to certain islands in the Indian Ocean, and we have never seen living specimens.

Mr. Hamilton promptly sent us several species of Coccidæ on the twigs, leaves, and fruit of the Lime, among them *Chionaspis citri* Comst. and *Mytilaspis citricola* Pack. The new insect, however, was not found upon the limes in the package, but upon certain curious costate leaves which Dr. Vasey

informs us are those of some species of *Chrysophyllum*, but whether of the common Star Apple or of some ornamental species could not be decided from the mildewed specimens received. Later letters from Mr. Hamilton state that it occurs also upon the cocoa and banana trees and other forest trees in the vicinity of the original *Chrysophyllum*. Upon the leaves of the last named tree it was clustered most abundantly upon the under side along the midrib. The leaves were abundantly covered with a smut-fungus*, particularly upon the upper

* This smut-fungus has been determined by Mr. D. G. Fairchild, of the Division of Vegetable Pathology, as *Antennaria pannosa* Berkley.

surfaces, which evidently originated in the honey-dew also abundantly covering the surface where it had evidently collected from the droppings from the insects on the under sides of higher leaves.

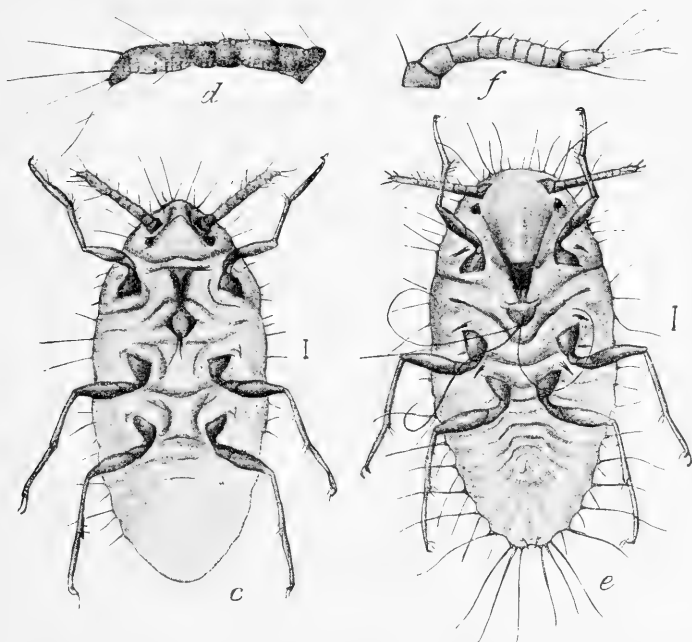


FIG. 15.—*Icerya montserratensis*: *c*, larva, second stage; *d*, antenna of same; *e*, larva of third stage; *f*, antenna of same; *c*, *e*, enlarged greatly; *d*, *f*, still more enlarged (original).

The species seems closely related to *I. ægyptiacum*, and possesses to a certain degree the same peculiarities in the arrangement of the secretion. From the insufficient material at hand we have drawn up the following partially complete description:

***Icerya montserratensis* n. sp.**

· EGG (Fig. 14, *b*).—Length 0.74mm. Narrow oval in shape; red in color; without visible markings.

NEWLY HATCHED LARVA (Fig. 14, *a*).—Compared with corresponding stage of *I. rosæ*: The antennal club is longer in proportion to the other joints, equaling joints 3, 4, and 5 together in length; the hairs upon joint 5 are longer than in *I. rosæ*: those upon joint 6 are identical. The six anal bristles are extremely long and stout, while those on the sides of the abdomen are of less than half their diameter at base and less than half their length and their tubercles lack the forward bend of those of *I. rosæ*. They are, however, much longer and stouter than in *I. purchasi*. The tubercles of the head bristles are very pronounced and the bristles reach beyond the third antennal joint. The secretory pores are abundant and are not arranged in rows, but occur all over the dorsum. In other respects as in *I. rosæ*.

FEMALE LARVA—Second Stage (Fig. 15, *c*, *d*).—Resembles closely the second stage of *I. rosæ*. The concavity on the outer side of the club of the antenna is more pronounced, giving the tip of the club a finger-like appearance; the hairs are shorter and sparser and the longest of the six anal bristles is only one-fifth the length of the body instead of one-third, as with *I. rosæ*.

FEMALE LARVA—Third Stage (Fig. 15, e, f).—Closely resembles the corresponding stage in *I. rosæ*.

The body appears slenderer and the legs stouter in the specimens at hand, but they may not exactly correspond in age. The last joint of the antennæ is longer, equaling 8, 7, and half of 6 together in length; the chitinous band at base of front coxæ is much slenderer, the tarsi are less curved, the hairs along the margin of the body are shorter and not so dark in color, and the antennæ are lighter in color, while the mentum and rostrum are hardly differentiated in color. The general color is red but duller than in *I. rosæ*. Occasionally joints 4 and 5 are consolidated, making the antennæ appear eight-jointed, with joint 4 nearly equal to 3 in length. In two specimens before us this occurs in the antenna of the left side and not in that of the right, and in another specimen it occurs in both antennæ. In one specimen joints 4 and 5 and joints 7 and 8 are consolidated in the left antenna, making it appear seven-jointed, while in two others joints 4 and 5 appear separated from below and consolidated from above.

The secretion is very abundant and pre-

sents a similar tufted appearance, the tufts arranged in dorsal, subdorsal, and lateral rows, about five to the dorsal row, six to each subdorsal, nine to each lateral, and one each to head and anus. The anal tuft early begins to exceed all the others in length, and by this character alone this species can in this stage be easily distinguished from *I. rosæ*. In some of our specimens in this stage it has reached a length of 3^{mm} and projects directly backwards, doubtless supported by the long and strong anal bristles. The color of the wax is light lemon yellow.

ADULT FEMALE (Figs. 16 and 17).—General color, reddish yellow; antennæ and legs black; broadly oval in shape, somewhat convex, 4^{mm}

long by 2.5^{mm} broad; hairs very inconspicuous and sparse, very much less inconspicuous around the lateral margin than in *I. rosæ*; sutures of segments distinct; body

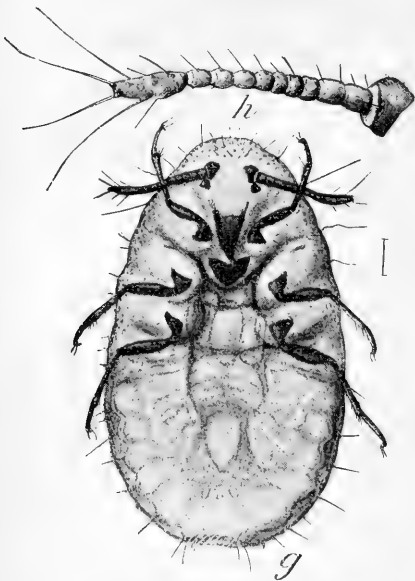


FIG. 16.—*Icerya montserratensis*: g, adult female, from below greatly enlarged; h, antenna of same, still more enlarged (original).

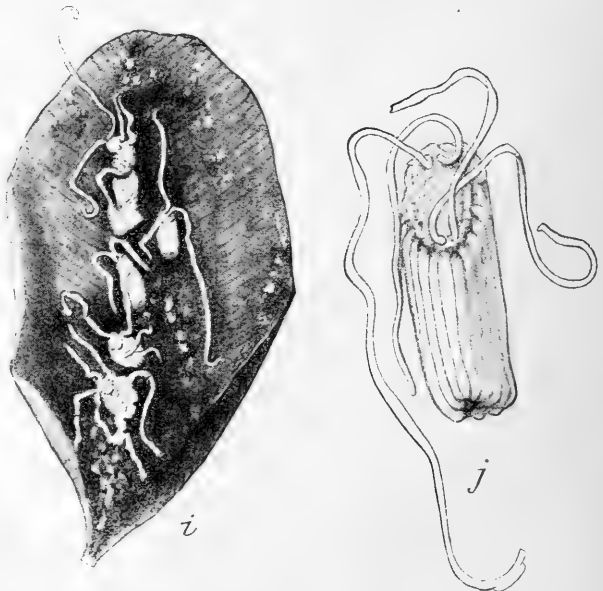


FIG. 17.—*Icerya montserratensis*: i, leaf of *Chrysophyllum*, showing the lice *in situ*, natural size; j, adult female, showing egg sac and appendages, three times natural size (original).

with a double outline from above, and obtusely serrate around lateral margin of abdomen. In the five denuded specimens three have ten-jointed antennæ, differing thus from any other *Icerya*. In the two remaining specimens joint 6 is divided into two, giving the normal number of eleven joints; in one antenna of one specimen the division is only faintly indicated. The club is proportionately considerably longer than in *I. rosa*, equaling the three preceding joints in length. Rostrum plain; secretory pores extremely abundant, particularly under the lateral edges of the abdomen; no indication of cylindrical lipped pores or of the glassy filaments seen in *I. purchasi*, and the dorsal honey-dew pore of the latter species is also apparently lacking, although the insect undoubtedly secretes honey-dew as previously mentioned. All tarsi one-half the length of their respective tibiæ. The waxy secretion is pure white in color and is dense and even over the dorsal surface of the body, and appears to be arranged in an irregular double row of tufts around the border. Certain of these tufts grow to an extraordinary length, particularly one which springs from near the head and another arising from the anal end of the body. The latter we have mentioned in our description of the third stage. Owing to the long journey and insecure packing all of the adults in our possession appear somewhat damaged, and our description of the arrangement of the secretion is doubtless very imperfect. In one specimen, however, this anal tuft of wax reaches a length of over 20^{mm}. The ovisac closely resembles that of *I. purchasi*. It is about twice the length of the body of the female in the specimens at hand, is regularly fluted, and about fifteen longitudinal flutings are visible. The body of the female does not appear to be pushed up so much by the growth of the sac as is the case with *I. purchasi*, and as a consequence the sac shows a tendency to turn up rather than down.

PALMER'S ICERYA.

(*Icerya palmeri* n. sp.)

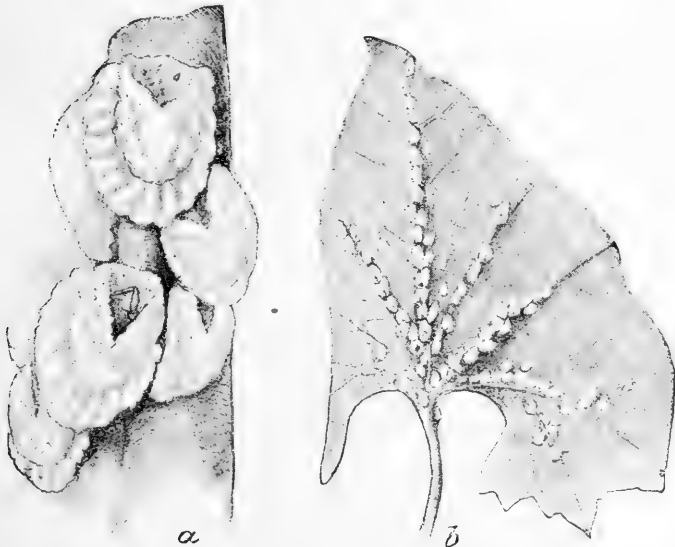


FIG. 18.—*Icerya palmeri*: a, cast skins of larvæ of second stage—greatly enlarged; b, same in situ on grape leaf—natural size (original).

In the winter of 1887-'88 Dr. Edward Palmer, the well-known botanist, while working over his previous summer's collections in Washington, handed us a number of leaves of the Muscat of Alexandria grape-

vine which he had collected July 30, 1887, at San José de Guaymas, 9 miles north of Guaymas proper, Sonora, Mexico. Along the main ribs, principally on the undersides of the leaves, were fixed many white scale insects which examination showed to belong to a new species of *Icerya*. The specimens consisted mainly of cast skins of the first and second stages, and, although a few dry and shriveled specimens of the lice in each of these stages were found, no adults or larger larvæ of either sex were present.

This material would, under other circumstances, seem very insufficient to warrant the founding of a new species, yet the characters are fairly good, it is evidently a new form, and the great economic importance of the genus justifies a description, however incomplete, in this connection.

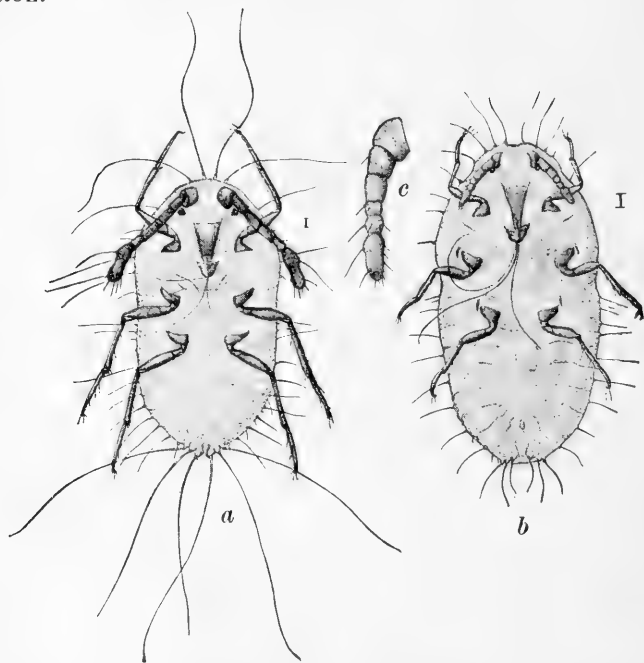


FIG. 19.—*Icerya palmeri*: *a*, newly hatched larva; *b*, larva, second stage—greatly enlarged; *c*, antenna of *b*—still more enlarged (original).

Icerya palmeri n. sp.

NEWLY HATCHED LARVA—First Stage (Fig. 19, *a*).—Color, reddish yellow. The proportions of the antennal joints are as in the other species, except that the club is somewhat longer than joints 4 and 5 together and has a large swelling at base followed by a constriction. The tarsi are long, nearly straight, and nearly as long as their tibiae; the chitinous band at base of front coxæ is narrow. The six anal bristles are very long and stout—as long as entire body. The twelve abdominal bristles (six each side above anal bristles) are only one-third as long as anal bristles; their tubercles project at right angles to the body and the bristles curve gradually backward. The head bristles are very prominent, particularly the two large ones between the bases of the antennæ, each of which reaches to the tip of the fifth antennal joint. The secretory pores are numerous and much larger than in the corre-

sponding stage of any other species of the genus; they have no special arrangement, but are scattered quite thickly over the dorsum and under the lateral edges of the abdomen. Even in this stage the waxy secretion is quite abundant, although no definite arrangement can be seen in the poor specimens at hand.

FEMALE LARVA—*Second Stage* (Fig. 19, b, c, and Fig. 18).—Color reddish yellow; legs, antennæ, and eyes brown, hairs yellow. Body stout, slightly concave. Antennæ six-jointed; proportions of joints as in *I. rosæ* except that joint 3 is considerably less than twice as long as joint 2, and 5 and 6 are somewhat stouter, while in the unsatisfactory specimens at hand the club does not seem to be concave on the outside. This last point can not be determined accurately without fresher material. The anal bristles are one-sixth the length of the body, and the other bristles are of insignificant length except four on the front which are as long as the antennæ. The tarsi are more curved than in the first stage and are about two-thirds the length of their tibiæ. As in the first stage the secretory pores are large and very abundant. The waxy secretion is very abundant. In the smaller specimens a dorsal and two sublateral rows of tufts are noticeable as well as a row around the margin of the body. In larger specimens, however, the dorsal and sublateral rows are lost and the secretion seems to form a more or less even coating over the surface of the body. The circumferential row remains distinct, however, and contains about thirty-five short, more or less distinct, tufts which are more readily distinguishable towards the anal end of the body. The wax is pure white, as also in the first stage, while in the corresponding stages of *I. rosæ* and *I. montserratensis* it is yellow, which color persists to the adult stage in *I. seychellarum*.

PARASITE.

Within one of the mounted individuals of the second stage is to be plainly seen the puparium of a Dipteron apparently of the family *Phoridae*.

CATALOGUE OF THE SPECIES OF ICERYA.

Genus **ICERYA**.

V. Signoret, *Annales de la Société Entomologique de France*, 1875, pp. 351-352.

Icerya seychellarum Westwood.

J. O. Westwood, *Gardeners' Chronicle*, 1855, p. 830.

Syn. *Icerya sacchari* Signoret.

V. Signoret, *loc. cit.*

Habitat: Madeira, Seychelles Islands, Rodriguez Island. *Food plants*: Sugar Cane, Palms.

Icerya purchasi Maskell.

W. M. Maskell, *Transactions and Proceedings of the New Zealand Institute*, 1878, p. 220.

Habitat: Australia, South Africa, New Zealand, California, Mexico. *Food plants*: Almost all plants, principally the Acacias and Citrus trees.

Icerya ægyptiacum (Douglas).

Syn. *Crossotosoma ægyptiacum* Douglas.

J. W. Douglas, *Entomologists' Monthly Magazine*, 1890, pp. 79-81.

Habitat: Cairo, Egypt. *Food plants*: *Ficus* spp.

Icerya rosæ Riley and Howard.

Riley and Howard, *Insect Life*, Vol. II, p. 333 (April, 1890).

Habitat: Key West, Fla. *Food plants*: Rose, Sugar Apple (?), Lime (?), Lemon (?).

Icerya montserratensis Riley and Howard.

Riley and Howard, *Insect Life*, Vol. III, pp. 99-103.

Habitat: Montserrat, W. I. *Food plants*: *Chrysophyllum* sp., Cocoa Palm, Bauana.

Icerya palmeri Riley and Howard.

Riley and Howard, *Insect Life*, Vol. III, pp. 103-105.

Habitat: Sonora, Mexico. *Food plants*: Grape.

SYNOPTICAL KEY TO SPECIES.

Newly Hatched Larvæ.

Six lateral bristles on borders of abdomen anterior to anal bristles not especially longer than other lateral hairs.

Two especially long hairs on antennal club, last segment of abdomen with a rounded median emargination..... *I. aegyptiacum* (Douglas).

Four especially long hairs on antennal club, last segment of abdomen not emarginate..... *I. purchasi* Maskell.

Antennal club with very many long hairs, of which five are especially long.
I. seychellarum (Westwood).

Six lateral abdominal bristles anterior to anal bristles, strongly differentiated from other lateral hairs.

These lateral bristles nearly as long as anal bristles, their tubercles directed forward, and the bristles having a very pronounced forward arch.

I. rosæ Riley & Howard.

The six lateral bristles less than half as long as the anal bristles, slightly arched forward, their tubercles issuing nearly at right angles to the abdomen.

Antennal club with a large swelling at base, followed by a marked constriction..... *I. palmeri* Riley & Howard.

Antennal club without especial basal enlargement and without constriction.
I. montserratensis Riley & Howard.

Adult Females.*

Body furnished with many very long, glassy, brittle filaments, each arising from a cylindrical lipped pore.

Egg-sac with strong longitudinal flutings..... *I. purchasi* Maskell.

Egg-sac smooth..... *I. seychellarum* (Westwood).

Body without such glassy filaments.

Border of body with a variable number of long curly tufts of wax.

Egg-sac with strong longitudinal fluting .. *I. montserratensis* Riley & Howard.

Egg-sac with faint longitudinal flutings..... *I. aegyptiacum* (Douglas).

Border of body with no long, curly waxy tufts.

Egg-sac not formed..... *I. rosæ* Riley & Howard.

* *I. palmeri* is not included in this table, as the adult is not yet known.

TEACHING ENTOMOLOGY.*

By Prof. A. J. COOK, *Agricultural College, Michigan.*

Ladies and gentlemen of the Entomological Club, I congratulate you that another year has passed, and our number has not been broken in upon by death. While our ranks have been much enlarged, no one has been called to that "undiscovered country from whose bourne no traveler returns."

I also congratulate you upon the great increment in our force of working entomologists. I think I may say, with no fear of contradiction, that no year in the history of America has been so remarkable in this respect as has the last. This is a cause for special felicitation not only to entomologists, but to all our people. Ours is a tremendous country—by ours I include, of course, our Canadian brothers, for we as scientists know no line of separation—and to spy out the entire land needs an army of workers or observers, all trained to keen sight and ready apprehension. But more than this the magnitude of our country is fully equaled by the magnitude of the insect hosts, and to know all of these, with their full life history, requires an incalculable amount of closest research. But our business economy demands this for all our species, for so wonderful is the balance of nature, so close the relations of all species of life, that really we may hardly divide insects into those important and those unimportant in our agricultural economy. All are important; and so from an economic, no less than a scientific, standpoint it is desirable that all such research be widely encouraged. And it is a most hopeful omen—the rapid increase of earnest and trained workers.

I shall not in this address occupy time to give the peculiarities of the season in respect to insects, nor yet call attention to the interesting discoveries, like the importation of the *Vedalia cardinalis*. All these will be brought out in papers and discussions. I must, however, refer to the new association for the advancement of economic entomology, which was organized at Toronto a year ago, and which held its first meeting in Washington last November. This meeting, under the presidency of Dr. Riley, was a valuable one, and that society promises much for the science of entomology, as well as for its economic development. It is also a matter of much interest that a new paper, *Entomological News*, is started at that great center of entomology, Philadelphia, which will also do much every way for our science. This, with the very excellent periodical, *INSECT LIFE*, published by the Entomological Division of the Department of Agriculture, can but give new impetus to entomological research. Supplementary to these we have an addition to Pro-

* Presidential address delivered at the meeting of the Entomological Club of the A. A. A. S. at Indianapolis, August 20, 1890.

fessor Comstock's admirable work, which, when completed, will form a most valuable adjunct in the development of entomology. If we may judge from what we already have, this will be invaluable in every entomological laboratory.

When the Society of Economic Entomologists was organized a year ago, it was remarked by one of our first entomologists, that that move sounded the knell of this club. I then remarked that such ought not to be the case. That society is to be composed of only those interested in economic entomology, and of course will only put emphasis in the direction of the practical aspects of the science. There will always be in attendance at the meetings of the Association for the Advancement of Science, more or less entomologists. It will certainly be valuable every way for such to meet. These will be entomologists in a wider sense, and so will include those interested in practical entomology and also in the science without relation to utility. The club then may well continue. I believe it will live and thrive and will be most helpful to entomologists and to our science. While the other association will discuss economic questions this club will place no limit on either its discussions or its membership, only so far as entomology shall be its aim and purpose. No one doubts but that he who has a thorough training in the science of entomology will be far better prepared for practical work, and so there can be only the most cordial relation between the Association of Economic Entomologists and this club; indeed, many of our most active entomologists will be members of both.

I have already stated the truism, that he only can do the best practical work in entomology who is thoroughly well grounded in the general science of entomology. As we now have a great call for entomologists in our experimental stations, agricultural colleges, and as State entomologists; not to speak of the fact that every farmer and fruit-grower would be more successful if he were well informed in this science; it goes without saying, that somewhere there should be in training, men for just such work. It seems to me that it needs no argument to show that our agricultural colleges are just the places where this training should be given. They were founded to teach those subjects which would be most serviceable on the farm. Entomology is one of the chief of these. Thus it follows that every student of agriculture should have a thorough course in this science, with the practical aspect of the subject kept in the foreground. In thus presenting this science to large classes—I have from thirty to forty each year who study this subject in the course—the teacher will find some in each class who are specially fitted to succeed. They enjoy the study, and work most earnestly, just for the love of the pursuit. They have quick observation and are very accurate and honest in all their work. It needs no prophet to bespeak success in this field for such students. Our agricultural colleges then are just the places to discover the men who have great pos-

sibilities in this direction, just the places to give the training that shall best fit men to do the most valuable work.

It will be my purpose, then, in the remainder of this address to describe the equipment for such work and to explain the method which I believe will give the best results.

Of first importance is a good library. This should contain all the standard works, periodicals, and monographs, so that a student who may decide to study any insect or genus may find what has been written upon the subject. Of course this can not be had at once, but it is so essential that no effort should be spared to build up a complete entomological library at the earliest possible moment. True, the scientist should study things, not books, but he will find a wise use of books most helpful in his study.

Next to a library, such colleges should have good collections, which indeed are often of more value than the library. A small show collection illustrating the families and orders, and the several stages of the most injurious species of the place, as well as the groups of beneficial species should be open to the public. This will be studied and appreciated by the practical farmer, who, as he visits the college, will find it helpful, and will also interest and stimulate the under-class men who will thus have their attention called towards insects before they commence the regular study, which will not occur till they are well along in the course. Drawing, botany, microscopy, and French and German, if thoroughly understood, will be great aids to the student who commences the study of entomology. Thus this study will come late in the course, and the show collection will be whetting the appetite of the under-class men from the time they enter college, until they commence this study.

I would also have what I call the student collection. This is a pretty full collection from the locality of the college. This I would hang up on the wall in the lecture room, which I would have dark except when in use, so as to preserve the color of the specimens. I would have this in rather small cases with glass in front and also back, where it is desirable, as in case of diurnals, to study both under and upper sides of the wings. This collection should show at least types of each group in all stages from egg to imago, as well as nests, cocoons, etc. This is an object lesson, even before the student is even ready for use, by the teacher to illustrate his lecture, and is at the disposal of the students in naming their own collections or in closer study of any group. It seems to me such a collection should be in every college. Lastly, I would have a laboratory collection, which should be a biological collection, and the fuller the better. This is in large, tight glass-faced drawers. I use the Harvard case. This is for use of the teacher and post-graduates who desire to study further in this science. It is too valuable for general use by the students, or to be kept to satisfy general curiosity.

THE COURSE OF STUDY.

As I have before remarked, before the student commences the study of insects, he should have had a good course in free-hand drawing, should have had instruction in the use of the microscope, and in preparing microscopic specimens and slides, and if he has a ready use of German and French it will be very helpful to him in his study. It is also desirable that the student should have had a good course in botany. The students at our college have had three terms of botany, one devoted entirely to microscopic botany, before they commence the study of entomology. I consider this very valuable preparatory work. Entomology is very close, precise work, and the laboratory work, if carried on for a less space than three hours at a time, is not satisfactory. But three hours of such close work is very wearying unless the student has had a fitting preparation. Thus I am pleased that our students have had vertebrate dissection, with human and comparative anatomy and physiology, before they commence entomology. I know this seems the reverse of the natural method, as nature proceeds from lower to higher; but vertebrate dissection is lighter and less trying to eye and brain than is the study of insect anatomy; thus I am pleased to have anatomy and physiology of vertebrates precede that of the arthropoda in our course.

In our college, the student attends a course of sixty lectures on the anatomy and physiology of insects, systematic entomology, and the economic bearing of the subject. These lectures are illustrated by use of models, the students' collection of insects, already referred to, by microscopic preparations, mostly prepared at the college, and elaborate charts and drawings also prepared specially for our use. In connection with this course there are thirty-six hours of laboratory work. Each student works three hours one day each week for twelve weeks. In this time, they are able to study the internal anatomy, and to examine carefully and accurately one insect of each order. In connection with this, several insects are traced to the genus by such keys as Leconte & Horn, Cresson, Williston, etc.

Besides the above, each student makes a collection of from ten to twenty-five insects of each order, all neatly put up, with date and locality label, each order by itself, and all labeled as far as time will permit. Many students succeed in naming a large number of their specimens. Each student is also required to mount insects in all the approved ways. Small insects are mounted on triangular pieces of card-board, on rectangles of cork, with silver wires, while the larvæ are put up in vials of alcohol with rubber corks, and also prepared by eviscerating, and drying while distended with air, in a heated oven.

The students are also encouraged to prepare biological collections in which they preserve the eggs, larvæ after each molt, pupa, cocoon, and imago of both sexes, and of various sizes, and the several varia-

tions. Some of our most enthusiastic students work out several such life histories, describing not only the separate stages, but the several parasites that work to destroy the insects. I regard this work as very valuable. It is excellent discipline for the mind and observation, gives accurate information of the most interesting kind, and arouses enthusiasm for the study as nothing else can. It is such work as this that will tell for the future of entomological research, that will make entomologists that will honor alike the fields of pure and applied entomology.

But such study ought not and will not stop here. Post graduates will avail themselves of the opportunities which such laboratories offer. Last winter, during our long vacation—ours is an agricultural college, and our vacations must needs occur in winter, when farm operations are largely at a stand-still—I had ten special students of entomology in my laboratory, one from South Dakota, one from Indiana, one from Ohio, one from Japan, one from Wisconsin, and the others from our own State. Nearly all were college graduates. Six special students, all graduates from colleges, have spent the year in my laboratory in special entomological study as post-graduate students. It seems to me that such are the young men that are going to develop the entomology of our country. They are the young men that can and will do grand work in our colleges and experimental stations.

These young men each take some special family or genus of insects, to which they give the major part of their time and study. They collect in all orders and give special attention to biological work, tracing the life history of insects, identifying the specimens they capture as far as possible, and try to become familiar with entomological literature, so far as they are able. These students are mutually helpful to each other, as the laboratory may be said to be a sort of perpetual natural history, or, more accurately, entomological society. Thus these students become familiar with the general laboratory work; indeed they each become a factor in some degree of carrying that work forward.

Here I will close by explaining briefly our method of laboratory work, which differs in some degree from the admirable plan which Professor Forbes explained at the Washington meeting of Economic Entomologists last November.

Our labels give in compact space locality, date, accession, and species number. The accession number agrees with a number—serial number—in our accession catalogue for the special year. Thus Ac. 400 shows that the insect or insects bearing that label were the four hundredth collected during that season. The Sp. number is given as the insect is determined and is the number of the insect in the catalogue which we use. Thus Sp. 25 is *Cicindela purpurea*, as that beetle is numbered 25 in Henshaw's catalogue of Coleoptera. In case the catalogue is not numbered, as is the case with Cresson's list of Hymenoptera, then we number it. We have a column in our accession catalogue for date, collector, person who named specimen, and also for remarks. This last

column is wide, and in it we can usually write all necessary information which we received in the collecting. If we are experimenting with or studying the insect our notes are kept on cards. These are numbered to agree with accession catalogue and are kept in serial order until we know the species, when we add species number as well. We now index the card and place it in its correct alphabetical position in our card collection. Thus we can very easily find our notes on any specimen, either by accession number or by the name of the species. This plan works well, and it seems to me is very economical in respect to time. Of course our students all see this scheme and become familiar with its workings.

ARMY WORM NOTES.

By F. M. WEBSTER.

The season of 1890 was not noted in Indiana for any considerable appearance of this pest, except in the extreme southern portion of the State. In Point Township, Posey County, a very serious invasion occurred on the farm of Mr. F. W. Nolte, whereby 150 acres of promising meadow was totally destroyed, not a pound of hay being obtained from the entire area. This meadow and adjacent cultivated lands were situated on second bottom of the Ohio River, and all were overflowed during March, the overflow remaining long enough to destroy the young wheat.

Very small, young worms were noticed in great numbers in the meadow on May 2, but the magnitude of the outbreak did not become apparent until some days after. By June 7 the worms had done their work and generally disappeared, leaving what was a few weeks before a fine field of thrifty growing timothy just coming into head, as bare as a stubble-field, except an occasional clump of red clover. While the young worms were observed generally throughout this meadow, the appearance of the place on June 14 indicated that their course had invariably been from the Ohio River, in precisely the same direction that a similar invasion is said to have taken in 1881.

On June 14, both pupæ and adults were found in considerable numbers, while parasites were literally swarming. These were chiefly *Nemora leucaniæ*, and in several instances they were in turn being destroyed by a spider, *Oxyopes scalaris*. The ravaged meadow was of two years' standing, other fields of one year's standing, situated near by were injured; but the destruction was not so complete, though a field of young corn, situated in the path of the advancing hosts was eaten to the ground.

While there is good evidence that the adult moths may oviposit in fields of small grain in spring, the fact of their ovipositing in fields of young corn seems not to have been recorded. From the 4th to 28th of

June, 1888, about La Fayette, Ind., we frequently observed the larvæ varying in length from one-half to three-fourths of an inch, depredating on the plants, in the midst of quite extensive corn fields, from 50 to 100 yards from the margins. With a single exception, the fields in which these worms were found had been cultivated for a number of years, and in all, the present crop was being continually worked with plows, thereby precluding the possibility of the larvæ having originated outside of these fields, and, except corn, there was nothing else to tempt the parent moth to deposit her eggs. The smaller larvæ were frequently attacked by a species of *Microplitis*, which Dr. Riley found to be similar to, but specifically different from that mentioned in the third report of United States Entomological Commission, p. 127. A peculiarity of this parasite was that after leaving its host, it usually constructed its cocoon under the body of the latter, after the manner of *Perilitus americanus*, which similarly attacks *Megilla maculata*. In this case, however, the body of the host was not so fastened as to form a protection, as in the case of *Megilla*.

AUGUST 12, 1890.

AN EXPERIENCE WITH ROSE BUGS.*

By Prof. J. B. SMITH, New Brunswick, N. J.

The rose-bug, or, more correctly, rose-chaffer, was known as a difficult subject to Harris and Fitch and the entomologists of their day. They gave us a fair life-history of the insect, to which Dr. Riley has quite recently added a good description of the larva, with figures, as well as some further biological notes. Each of these authors seems to have been fully aware of the difficulty of dealing with the insect, and the recommendations as to remedies are vague and unsatisfactory. Fitch gives an excellent description of the way in which the invading swarms cover everything, apples and other fruits becoming so covered that a mere mass of yellow sprawling beetles indicates that here probably is a fruit.

Southern New Jersey has been invaded for several years past, which cleared out the grape crops so completely year after year, that many vineyards have been taken out and others will be abandoned unless some practical remedy is found. With the view of testing the value of the published methods I spent some days in the invaded districts. I found that, as a rule, the insects did not breed in cultivated land, but that, on the other hand, the entire sand region is a vast breeding ground, pupæ being found even at the very sea-shore. From these breeding places the insects emerge and fly about, searching for food, the winds apparently influencing their direction to some extent. Vineyards are

* Republished from *Garden and Forest*, July 16, 1890.

therefore generally invaded from the edges, newly-arriving hordes ever advancing farther. They are not at all dainty in food habits, but do show some preferences. Sumach is readily eaten; apples and cherries are tidbits; sour gum attracts them by the million; hollyhocks are eaten, stems and all; roses are high favorites, while the peach is not so much liked. In fact, there is scarcely a plant they will not eat, though flowers and some fruits are always preferred. A field of blackberries at Colonel Pearson's place was swarming with them, and the Colonel told me that last year his strawberry patch looked yellow where red ought to have been seen.

Pyrethrum has been highly recommended for these insects. I tried it first at the rate of 1 ounce to 1 gallon of water. It acted in about ten minutes, the majority of beetles tumbling from the blackberry-bushes to the ground. Only a few, however, were really stupefied, and most of them began crawling back upon the plants immediately, where, as soon as the sun dried them, they fed as freely as before. Then I increased the dose to one-fourth of a pound to a gallon of water. The effect was more prompt, the resulting stupor more lasting, but half an hour later all were again feeding on blossoms that were yellow with pyrethrum. The insects will live for an hour or two in pure powder, and recover when removed from it. Tobacco seems to give an added relish to the plants upon which it is applied. Sprayed on at the rate of a pound to the gallon, the powder being added to the decoction, the beetles never stopped eating. London purple, applied as strong as the grape would bear, did not prevent the destruction of the blossoms, but left a sprinkling of dead beetles on the ground. Powdered naphthaline, pure, and mixed with carbonate of lime, was dusted over a row of vines with the most approved appliance, so as to leave the vines white. This had not the slightest effect, so far as the blossoms are concerned, and the leaves were eaten from below instead of from above. Carbollated lime was equally ineffective, as was also the pure hydrate of lime, which is better than air-slaked lime as a rule. Hellebore applied pure is utterly ineffective. Mrs. Treat showed me some foxgloves in her garden, each plant surrounded by dead rose-bugs. Colonel Pearson thereupon made an infusion of leaves, which was ineffective, while I fed a lot of the beetles for a week upon roses which were soaked in a saturated solution of digitaline. Quassia is useless, and so were all the copper compounds, the saturated solution of lime, the iron solutions, the kerosene emulsion; and, in fact, everything else that was applied. All this goes to show what a tough subject we have to deal with. Corrosive sublimate will kill him readily, but unfortunately kills the plants as well. A sludge-oil soap, obtained too late to test thoroughly, kills the beetles without injuring plants. It is probable that in this we have a good remedy for the *Macrodactylus* if it can be made cheaply enough.

Of the mechanical means tried, an umbrella, with a sack attached, into which the beetles were jarred, proved satisfactory, and this can be used

at all times of the day, since the beetles can not fly out of a sack as they could off a sheet or from the ground.

My conclusions are that the only way to save a crop of grapes is to plant spiræa, roses, or blackberries between some rows of the vineyard, and, by persistent collecting, keep these plants free and attractive. How persistent one must be is shown by the fact that though Colonel Pearson one year went over his vineyard once a day killing beetles, yet they destroyed his grapes almost completely. This year, though he daily cleared his rose-bushes by applying the sludge-oil soap, yet every bud was eaten.

The Clintons, many of them, bloom and set before the rose-bug arrives in force; they are then generally safe, since the beetles prefer the foliage of the grape. The Concord buds are just right for the insects, and they go completely. The Concord foliage is not relished, and only the upper surface is eaten. Very late-blooming varieties are also fairly safe, and this indicates another method of dealing with this pest, *i. e.*, plant very early or very late blooming varieties, while supplying something for the insects to eat. I may say that the suggestion that spiræa be planted as an attraction is Mr. Fuller's, and he reports that he saves his grapes in this way.

There is one glimmer of hope ahead. Indications of a decrease in the number of the insects are observed, and natural means may end the invasion. Some eighteen or twenty years ago there was a similar invasion lasting four or five years. The present flood began about four years ago, and in some places is undoubtedly on the decrease. Colonel Pearson did not suffer nearly as much this season as he did last season, and others have made the same statement.

NOTE ON THE PERIOD OF DEVELOPMENT IN MALLOPHAGA.*

By HERBERT OSBORN.

The habits of the species of Mallophaga render accurate observations upon the time required in development of the eggs a matter of considerable difficulty. While in some of the species upon very common birds it is possible to get an abundance of material, in other cases the opportunities for obtaining such material are very rare. But in the most common species the difficulty of determining the exact time of deposition of eggs, and then of keeping individuals in such conditions as to insure a normal development, makes positive observations difficult. This being the case, any observations which may add to our knowledge of the subject seem of interest, and the present note is offered as one such contribution.

* Read before the Entomological Club of the American Association for the Advancement of Science at Indianapolis, August 21, 1890.

The species chosen in the present case is the *Nitzschia pulicare*, which is almost invariably to be found in abundance on the common Chimney Swift (*Chaetura pelagica*). This bird is an abundant resident of the building in which my laboratory is located, and being readily obtained on account of its tendency to fly in at the windows, I suggested to Mr. P. H. Rolfs, a graduate student in biology, that he attempt the rearing of larvæ from eggs with a view to determine the length of developmental period in connection with studies of its embryology.

For this first purpose he secured on two separate occasions a number of the eggs, and kept them, part in a tight pasteboard box in his vest pocket, the others inclosed in cotton-plugged tubes under a hen that was kept in the laboratory at the time for incubating eggs for embryological work. Of the first lot, all kept in pocket, secured July 27, two eggs hatched August 4, five between August 8-13, one August 16, the last giving twenty days as the longest period.

Of the second lot secured August 3, six hatched between the 8th and 13th, four hatched August 14 (three in box and one in tube), two August 15 (one in box and one in tube), part not hatching, the longest period in this case being thirteen days.

Assuming that those requiring the longest time had been deposited but a short time before the experiment began, we would have from fifteen to twenty days as the ordinary time required for the eggs to hatch for this species.

THE CYPRESS TWIG BORER.

(*Argyresthia cupressella* Wlsm.)

By D. W. COQUILLET.

Every spring a large percentage of the cypress trees growing in the city of Los Angeles present a brownish aspect, as if they had been scorched by fire; this is especially the case with trees allowed to grow naturally and that have not been trimmed. This is the work of a Tin-eid, the larva of which burrows into the tender twigs, causing them to wither and finally to turn brown. The larva enters the twig some distance from the apex, and extends its burrow downward, but the latter seldom exceeds an inch in length, after which the larva deserts it and attacks another twig in a similar manner. Only the smaller and more or less terminal twigs are attacked, these seldom exceeding the size of the lead in a common lead-pencil. The opening of the burrow is usually closed by the blackish castings of the larva, which form a conspicuous object on the outside of the twig. The twigs attacked die back as far as the burrow extends, and when the latter extends into the main twig this also dies back to the point of attack.

This larva attains a length of about 7^{mm}, is of a light-green color, and in the older ones there is an indistinct, reddish dorsal spot on the

eighth segment, appearing as if located beneath the skin; piliferous spots and spiracles concolorous; cervical shield tinged with yellow; anal plate slightly brownish; head brownish-yellow, marked with a brown dot each side above the jaws.

When fully grown the larva deserts its burrow and spins a white cocoon, which it fastens to two or more twigs. There is only one brood in a year, the larva appearing from February to April and the moths issuing in April or early in May. These evidently lay their eggs in the course of a few weeks after issuing from the chrysalis, and the eggs remain upon the trees unhatched until the following year.

I have found this larva attacking the tender twigs of the following trees: *Cupressus macrocarpa*, commonly known as the "Monterey cypress," and largely used for hedges; *Cupressus lawsoniana*, *C. pyramidalis* and *C. guadalupensis*. They are most abundant on the common *C. macrocarpa*. I have never found them on any other trees than those named above, although several different kinds of Conifers, such as *Pinus insignis*, *Sequoia gigantea*, *Thuja orientalis*, *Cedrus libani*, and *Cupressus funebris* were frequently growing within a few yards of the infested trees.

The larvæ have a habit of letting themselves down a distance of a foot or more by means of a silken thread, and while in this position are sometimes devoured by the common Humming-bird; on one occasion I saw one of these birds devour upwards of a dozen of these larvæ in the space of a few minutes. Of natural parasites I have bred from one of these larvæ, or from a chrysalis, I am not certain which, a single specimen of Ichneumon-fly belonging to the genus *Porizon*, but the specimen is too much mutilated to admit of a specific determination.

The moth is not named in my collection, but I have sent specimens of it to Professor Riley, to whom I must leave the proper identification of the species.*

NOTES ON THE GENUS ARGYRESTHIA Hb., WITH DESCRIPTIONS OF NEW SPECIES.

By LORD WALSHINGHAM.

The genus *Argyresthia*, as represented in the United States, has undoubtedly been much overlooked. Many species allied to, if not identical with, the numerous European forms may be expected to be found, but up to the present time only thirteen species have been recorded from the United States, to which I have now to add descriptions of three new ones, and to record an additional species known in Europe. With some of the described species I am still unacquainted, and it is possible that

* The species proved to be undescribed, and in the current number will be found a communication from Lord Walsingham, in which he has kindly characterized it in connection with some notes on the genus *Argyresthia*.—C. V. R.

one or more of them may turn out to be synonyms, but no reliable evidence to this effect is to be gathered from the often too meager descriptions. For this reason I am unable at present to suggest any new synonymy.

The Revised Index will stand at present approximately as in Chambers' edition, with the addition of the five subsequently recorded species, including the four here mentioned, the fifth being described in the Transactions of the American Entomological Society, X, 173 (1882), as *subreticulata* Wlsm.

Argyresthia mendica Hw.

A specimen submitted to me for examination by Dr. Riley in July, 1886, appears to be not separable from *mendica* Hw. from the European form of which it differs, perhaps, in having the white portions of the wing somewhat less conspicuous, especially the costal dots.

Argyresthia cupressella sp. n.

Antennæ, basal joint clothed with white hair-scales; stem distinctly annulated with black and white.

Palpi, short, depressed, ochreous.

Head, white.

Thorax, shining golden-brown.

Fore-wings, shining, mottled with golden-brown and creamy-white, the latter appearing in a broad, inwardly-oblique spot near the base of the dorsal margin, followed by a smaller costal spot at one-fourth from the base, and in an oblique and somewhat waved central fascia, wider and nearer to the base on the dorsal than on the costal margin, below which it is slightly bent outwards, followed by two costal and one dorsal spot of the same color; the first of the two costal spots is smaller than the second, and reaches almost, or quite, to the anal angle of the fascia, sometimes forming a separate costal fork of the fascia itself. About the apex are three or four small spots of a similar color, followed by a few black scales at the extreme tip; cilia, pale golden. *Underside*, steely-gray, with an aureous tinge about the cilia.

Hind-wings, pale grayish, with a slight ochreous tinge in the cilia.

Abdomen, grayish, anal tuft ochreous.

Legs, whitish, tarsal joints faintly indicated above by slightly darker spots.

Exp. al., 8mm.

Larva, on cypress, the perfect insect appears in April.

Hab., Los Angeles (California).

The description is taken from a good specimen received with three others from Dr. Riley, to whom they had been submitted by Mr. D. W. Coquillett; both sexes were represented. The markings have evidently much tendency to blend into each other so that the exact position of the pale spots is not always clearly defined and would be scarcely traceable in a worn specimen. This species is allied to the European *abdominalis* Z., from which its darker coloring and more checkered pattern at once distinguish it.

Argyresthia freyella sp. n.

[*Antennæ*, missing.]

Head and thorax, white.

Fore wings, shining, mottled with silvery-white and golden-yellow; the silvery-white markings consist of a spot at the middle of the base, two pairs of wide, nearly opposite, outwardly oblique, costal and dorsal streaks, the dorsal commencing a little before the costal and blending with the latter about the middle of the wing; beyond the outer costal streak are three more small costal spots, the first of which is diffused towards the middle of the wing, tending to blend with the angle formed by the preceding pair; there is also a faint indication of dorsal spots at the base of the cilia; there is a distinct triangular black dot at the extreme apex; cilia, golden-yellow, whitish at their bases. *Underside*, pale, brassy-ochreous.

Hind-wings very pale grayish with an ochreous tinge throughout the cilia.

Abdomen, grayish, ochreous at the base.

Legs, sordid whitish, with very faintly speckled tarsal joints.

Exp. al., 8^{mm}.

Hab., Dallas (Texas). Boll.

Type, ♂, *Mus. Wism.*

This species is described from a single specimen in the Frey collection. The white head and thorax at once distinguish this species from *cupressella*, which it greatly resembles in the disposition of its markings, although it differs in the paler golden-yellow of its fore-wings. The markings are so ill-defined, tending so much to blend into each other, that the above description can only be taken as an attempted indication of their general pattern. It is extremely probable that this is a specimen of the species referred to by Zeller [Ver. Z.-b., Ges. Wien xxiii, 106 (1873)] under the name *abdominalis* Z., but it is in sufficiently good condition to show that the pattern and markings are quite different from those of the European species; indeed it is more nearly allied to *cupressella* than to *abdominalis*, although it may be regarded as intermediate between them. In *abdominalis* the white ground color of the wings is cleaner and brighter and decidedly predominates, whereas in *freyella* the wings are much more golden although the costal and dorsal oblique streaks are wider, nor indeed are these streaks to be found in the same position in the European form. I have no hesitation in regarding *freyella* as abundantly distinct. The pale markings are decidedly not dark margined in either of these species, nor is there any fuscous sprinkling. In these respects they differ from *quercicolella* Chamb., and this species must therefore be regarded as distinct. Chambers's identification (Can. Ent. xi, 144, 1879) notwithstanding.

Argyresthia plicipunctella sp. n.

Antennæ, annulate with white and brownish-gray.

Palpi, sordid whitish.

Head and thorax, white.

Fore wings, white, densely dusted above the fold with grayish-brown; a marginal line of dark brownish runs around the apex at the base of the cilia, contiguous to which are two or three ill-defined brownish spots; beneath the basal portion of the fold is a series of distinct grayish-brown spots; at the outer third of the fold is a strong brownish spot lying in the fold itself, distinctly separated from

the dorsal margin by the white ground color of the wing which occupies nearly the whole of the space beneath the fold; the extreme costal margin at about the middle is slightly speckled with grayish-brown; cilia grayish about the anal angle, grayish-brown around the apex, with whitish interruptions along the costal margin.

Hind-wings, pale grayish, shining; cilia pale grayish-ochreous.

Abdomen, cinereous, anal tuft paler.

Legs, dull whitish, tarsal joints faintly spotted.

Exp. al., $10\frac{1}{2}$ mm.

Hab.

Type, ♂ ♀, *Mus. Wlsm.*

This species is nearly allied to the European *retinella*, but has not the same blotched appearance on the outer half of the fore-wings, the more clearly defined spot on the fold and the marginal line around the apex at once distinguishing it from that species.

In addition to these I have single specimens of two undoubtedly distinct species, the one allied to the unmarked variety (*ossea* Hw.) of the European *nitidella*, but with a slight golden gloss, taken near Crescent City, Del Norte County, Cal., the third week in June, 1872; the other reminding me of what should be a small form of *altissimella* Chamb., taken in Mendocino County, Cal., at the beginning of June, 1871. I am not disposed to describe these from single specimens.

EXTRACTS FROM CORRESPONDENCE.

The Bermuda Peach Maggot and Orange Rust.

Your letter of the 22d of July reached me a day or two ago. Since I last wrote you I have occasionally looked for the *Ceratitis*, and not many days ago discovered the pest among and lodging on some lime trees and fruit, also among the grape-vines. So far as I know this insect does not injure the orange in these islands, and I should be very much pleased to learn from you in your next in which way they injure the fruit. We grow now very little fruit in this island, owing to diseases of one kind or another. For instance, orange trees, bearing the most delicious fruit up to five or six years ago, have ceased to produce fruit, and have died down limb by limb in one year, then made a strong effort for life, sprung and started into bud, but died down again with greater rapidity, and so on year by year until at the end of three or four years they have died altogether. Can you explain this? Is the soil exhausted, or is it a borer or tree lice which cause this death to the orange trees? Before this trouble the oranges would be covered with what is generally called rust, which is most unsightly, preventing the oranges from turning yellow, although the pulp seemed to be uninjured; but, so far as I know, no other injury has happened to the fruit except the premature decaying of the trees, which I have endeavored to explain briefly in the former part of this letter. The Surinam cherries ripen about June and the Mangoes about September. The cherries have been very full of maggots, quite one-half of the crop ruined. We have also another fruit, known as the Loquat or Malta plum, which ripens in February, and this has also been infected to a greater or lesser extent. My father-in-law, Dr. T. A. Outerbridge, has had some peaches ripened this season, which were most securely protected from the flies by the use of mosquito netting.—[Claude W. McCallan, St. George's, Bermuda, August 6, 1890.]

REPLY.—Your finding of the *Ceratitis* upon the lime trees and fruit is very interesting and I hope you will watch the particular tree upon which you found them in

order to see whether they lay their eggs upon the fruit. This insect injures oranges in other countries in much the same way as does the Morelos Orange Fruit-worm (*Trypeta ludens*) in Mexico. I think that I sent you a copy of Dr. Riley's account of this latter insect. The eggs are laid on or thrust into the skin of the orange and the larvæ burrow into the pulp of the fruit. I should be glad to receive specimens of the maggots which infest the Surinam cherries, and hope that you will examine the Mangoes to see whether they are not also infested. The possible infesting of these fruits as well as the Citrus fruits by this *Ceratitis* is very important, as you will readily see, from the stand-point of any remedial work which has to be done upon the *Ceratitis* injuring peaches.

The rust upon your oranges is probably produced by the Rust Mite (*Phytoptus oleivorus*) and is remedied in Florida by applications of sulphur mixed with lime in the process of slaking and afterwards sprayed in a watery solution. The dying of your trees is probably due to the disease known in Florida as the "Die Back," which is caused by a fungus. This disease yields to treatment with carbolic or creosote washes provided the existing cause is removed, and this latter has been variously ascribed to overfertilization, deep planting, and imperfect drainage.—[August 19, 1890.]

The New Mexican Epilachna..

I notice on page 376 of INSECT LIFE, Vol. II, for May and June, 1890, that the *Epilachna corrupta*, which I trust will continue to be known vulgarly as the New Mexican Bean-bug or New Mexican bean-eating Lady-bird—for I have not been able to learn that it feeds upon any other plant except those of the *Phaseolus* family—is also found in Colorado. From this I infer that the so-called arid region of the Rocky Mountains is its native *habitat*. But I also venture to foretell that if it should ever chance to spread further east, it will prove as destructive to the bean there as the *Doryphora decemlineata* once proved to the potato. You suggest Paris green as a remedy, and it may therefore be interesting to you to know that I have tried its appliance, and to learn how it resulted. I may say that it effected a radical cure. It killed not only the insects, but also a great part of the vines (especially those of the wax-pod varieties, which appear more delicate), and utterly ruined several rows of new varieties, such as the Yosemite Mammoth, Dwarf Lima, Bush Bean, Flageolet Wax, Black-eyed Wax, etc., which I had obtained from New York at considerable expense for trial in our soil and climate. The green-pod sorts resisted better, especially the "Emperor William," a splendid large-podded variety with pure white-colored seed, which deserves to be planted extensively, both as a string and shell bean. The only bean plants that escaped entirely unscathed under the Paris-green treatment, among some fifteen sorts grown in rows side by side for experimental purposes, were the native frijoles, which remained entirely unaffected by the corrosive action of the arsenious poison. The row of these Mexican beans now stands in the garden, still growing in wonderful exuberance, and covered with an immense profusion of pods, some of these already ripening, while of the other beans probably not over one-fourth are alive. I would therefore advise great care in the use of arsenical compounds with beans, as it appears to corrode and burn both the leaves and stalks. The solution used was at the rate of 1 pound to 100 gallons of water and was applied about three weeks ago, once. On account of its great *rusticity* and wonderful productiveness and hardness the Mexican frijole seems to me to be deserving of a trial in the "States," especially for field culture. It is of all shades of color when shelled, but the appearance of the plants show no difference in growth. It makes a larger bush than the sorts cultivated in the States, inclined to run somewhat, although it requires no poles. On account of its remarkable vigor, it suffers less from the attacks of the bug than the more delicate and tender sorts raised in the States, and also stands late spring frosts which would kill the others. Used dry it is much more delicately flavored than the white navy bean so much cherished by the people of the "Hub," rather resembling the Lima bean in delicacy of taste. But it has one drawback, it has a brownish appear-

ance when cooked. The *Epilachna* made its first appearance here about the 25th day of June, and now some belated stragglers are still occasionally met with. The only safe remedy I know of against the insect is to plant the beans either very early, or very late, here from the 15th of April to the 1st of May, and from the 15th of June to the 10th of July. The beetle does not seem to trouble the very young plants, and is not found after the 1st of August in this locality and latitude. I inclose a few of these frijoles of various coloring, in another envelope; among them a large seeded greenish white sort appears to me to deserve some attention. Last spring I collected about a quart of this peculiar sort by hand-picking them myself from among the others, and will gather quite a large crop from them. It never enters the heads of Mexicans to select seed for planting, and I had to run over perhaps two bushels of beans to pick my quart. I also inclose a specimen of a little striped flea which is very pestiferous here in early summer. It alights in great numbers on various plants, even weeds, and perforates them like sieves. It had, among others, taken a great fancy for my Yosemite Mammoth Bush beans (costing one half a cent a bean) and preyed extensively on them. I used Dalmatian insect powder at first, and afterwards Paris green, with the results stated.—[John F. Wielandy, Santa Fé, N. Mex., July 26, 1890.]

REMARK.—The inclosed beetle is *Systena teniata* Say. It is a common insect and known to work on common plants, particularly the *Cucurbitaceae*. It is exceedingly variable in coloration, and up to within a very recent time it was divided into several distinct species.—[August 4, 1890.]

Adulteration of Paris Green.

I wish to call the attention of the proper authorities to the adulteration of Paris green which has now become very common in this country. Not knowing exactly to whom to write upon the subject I venture to do so to you, hoping the Department of Agriculture is sufficiently interested in the cotton crop to take note of the matter and call the attention of the proper authorities to the subject. The Paris green sold exclusively in this portion of the South last season was so badly adulterated that in many instances it killed cotton, while in others it had no effect upon the worms, no matter how liberally it was used. In some instances the Paris green was so mixed with very fine white sand that I found as much as 7 pounds of sand left in the dusting bag after sifting out the green in one package of 25 pounds. I do not know what other adulterations are used, but they are something that either do no good or else injure the cotton plant seriously. Now, I know from experience that pure Paris green will not harm cotton, no matter how liberally applied, for I last season obtained a 14-pound can of painters's pure green and sifted some of it as an experiment on some cotton until the leaves and blossoms were literally covered with it, and not one leaf or blossom was injured. In using adulterated green, from 4 to 5 pounds is required, while of pure green a pound per acre would be sufficient if you could distribute it in as small a quantity as that. I do not know if there is a law covering the adulteration of this article, but if not, I think something should be done for the protection of the cotton crop, and would suggest that you call the attention of Congressman Charles J. Boatner, of this district, to the matter, and perhaps a bill can be passed regulating the matter. In the event of the appearance of worms this season an immense quantity of Paris green will be required, and it is likely they will come as the crop in the entire valley is late and will be young and tender and easily and quickly destroyed unless the ravages of the worms can be stopped by the prompt application of the green. If dishonest manufacturers flood the country with an adulterated article that will not be effective the crop will be destroyed, for only those who have had experience know how rapidly a cotton crop can be eaten up by worms. In my opinion Paris green should be subject to inspection and a strict test, just as many other articles are inspected before going on the market, and a severe penalty should attach to the tampering with or adulteration of the article after it has received the inspector's stamp.—[Samuel Coulson, Bullitt's Bayou, La., July 9, 1890.]

Two Grape Pests in Alabama.

I inclose some specimens of beetles and Hymenoptera. Will you kindly inform me what they are and how I can get rid of them, especially the beetles? These perforate the leaves of my grape vines to such an extent that they have arrested their growth and have caused them to shed many of their leaves. What is the best remedy for this evil? Where are the eggs laid? They have made their appearance here for the first time to my knowledge. They do their mischief mostly at night, while the Hymenoptera are on the young canes during the day and suck the sap from them as a mosquito draws the blood from an animal; they might be called vegetable mosquitoes. I catch and kill most of them, though they are cunning little fellows, and dodge around the canes of the grape-vines, as a squirrel runs around a tree. The beetles though are a great pest, and I fear they will greatly damage my grapes, if they have not already done so. The nocturnal habits of this coleopteron give it every opportunity to commit its depredations.—[William C. Avery, M. D., Greensboro, Ala., June 25, 1890.]

REPLY.—The beetles sent are specimens of the Grape vine *Colaspis* (*Colaspis flavida*), and belong, together with the Grape-vine Flea-beetle and the Grape-vine *Fidia*, to the family *Chrysomelida*. The injury occasioned to the Grape by the *Colaspis* is caused by the adult insect only. In the larval stages it feeds on the roots of the Strawberry. The larvæ may be found on the strawberry roots throughout the fall and winter. They change to pupæ in June and the beetles soon after emerge and feed on the tender leaves of the Strawberry and later spread to other plants, attacking the grape-vine chiefly. The history of this insect is given at length, with illustrations, in Riley's Third Missouri Report, pages 81 to 84, and in the Fourth Report, page 34. The injury occasioned by the adults in defoliating vines may be prevented by spraying with London purple. A mixture in the proportion of 1 pound of the London purple to 100 gallons of water will effectually destroy the beetles, and will rid the vines of numerous other leaf-feeding insects. The specimens sent and termed "Hymenoptera" prove to be one of the common "leaf hoppers"—*Proconia undata*—one of the false bugs or Homoptera. This species occurs on vegetation generally, but seldom occurs in sufficient numbers to cause any annoyance. It is said to deposit its eggs in single rows in the grape stem and doubtless also deposits them in other plants. Should their numbers warrant it this insect can be destroyed by jarring it on to cloth screens saturated with kerosene. The grape-vine *Colaspis* may also be destroyed by the same means.—[June 25, 1890.]

London Purple and Paris Green for the Boll Worm.

I wrote you some months ago in regard to the best methods of combating ravages of Boll-worm, and you were kind enough to reply. Now I seek additional information, as I see abundant evidences that we will lose our cotton again by them.

- (1) What poison is best, Paris green or London purple?
- (2) For small farmers, what method of application is most efficient?
- (3) If by spraying, what apparatus is most satisfactory; the same if dusting the poison on is advised?
- (4) If spraying is advised, what is the proper strength of poisoned water, how much poison to a gallon?
- (5) What is the chemical name of Paris green and "London purple," and if either can be made soluble in water and still retain its poisonous properties? Anything new elicited in the past few months?

If you will kindly answer the foregoing questions and embody in your reply any other suggestions, I will take occasion to give your answer large circulation through the county press of this section of the State, in order that farmers may have the benefit thereof.—[H. L. Tate, M. D., Lindale, Smith County, Tex., June 13, 1890.]

REPLY.—A copy of the Fourth Report of the United States Entomological Com-

mission has been sent to you in response to your former letter; it contains in its first part, in treating of the Cotton Worm, an elaborate chapter on the application of arsenical poisons to the cotton plant and upon referring to that portion of the Report (pp. 136-153) you will find full particulars regarding the points you asked me in your last letter. I have pointed out that a *timely* application of Paris green or London purple, not only protects the plants from the Cotton Worm, but is at the same time the best remedy that can be recommended for the destruction of the *young* Boll-worms before these enter the bolls. The report was published in 1885 and since that time no new discoveries have been made regarding the mode of application of these poisons. It will be necessary, therefore, to reply but very briefly.

(1) London purple can not be said to be better than Paris Green, but it is a good substitute and much less expensive. (See fourth report, pp. 143 and 151.)

(2) This depends entirely upon circumstances: Water is often not handy, and small planters are liable not to have any spraying apparatus on hand. For these reasons the dusting method is often resorted to, but it is much more expensive on a large scale than the spraying method. In a general way it may be said that the spraying method is very much preferable, especially in dry or tolerably dry weather, while in very wet weather the dusting method gives the most satisfaction.

(3) Any of the improved force pumps which are now in the market, in connection with a good atomizing nozzle, and more especially the "Riley" or "Cyclone Nozzle," which is described on pages 211-219 of the fourth report. For the dusting method simple hand dusters can be obtained, or, if nothing else be at hand, a broad sieve with a double layer of fine muslin covering the bottom will answer the purpose.

(5) Neither Parisgreen nor London purple, being compounded substances, have chemical names; the analysis of London purple is given on page 149 of the report. Neither are soluble in water though London purple has a larger proportion of soluble matter.

The chief requirements in successful coping with either of the worms are: (1) Watchfulness for the first appearance on the under side of the leaves, and early spraying before the leaves become seriously eaten or ragged; (2) spraying as far as possible on the under side of the leaves and as finely as possible in order that the poison may adhere and not be washed off.—[June 19, 1890.]

The Tent Caterpillar.

The apple trees in this vicinity are greatly overrun by the Tent Caterpillar, the larvæ of "*Clisiocampa americana*" and much damage is being done to orchards and isolated trees. In a recent walk I counted over one hundred apple trees completely denuded of buds and leaves, while on one half-grown tree I counted eighty-nine of their nests. About June 1 there were hosts of the larvæ everywhere—on fences, bushes, over our gardens, on windows, doors, and trying to gain an entrance at every opening into our houses. For a time it seemed like a new edition of an "Egyptian plague," but the cold stormy weather has destroyed them, or else they are ready to make the change into chrysalid state, for at present they are not troublesome. Our trees blossomed well, but this pest will cause a change in the crop estimates of the early spring.—[Lewis E. Hood, Ashland, Mass., June 12, 1890.]

An Orthesia on Coleus.

By to-day's mail I send you a sample of Mealy Bugs which have caused me a great deal of trouble on our Coleus. I think I got them from P. Henderson's last winter on some new Coleus. They propagate very fast. I got rid of millions of them by dipping the plants in a solution of fir-tree oil, but it was an expensive job. Do you know of a better remedy? Is it a new bug or an old one? I have never seen it before. I am much obliged to you for the advice you gave me last winter.—[Charles Freund, Rye, N. Y., June 16, 1890.]

REPLY.—The specimens received belong to the Coccid genus *Orthesia*. The insect is apparently a new one and has not been hitherto described. It has been received

from New York and California, and in both cases was reported to infest Coleus. In the same line of your experiment with fir-tree oil would be the application of the kerosene emulsion, which will doubtless be as effective as the former treatment and less expensive. If you are not already acquainted with the method of making this emulsion, the accompanying formula will give ample directions.—[June 23, 1890.]

The Cottony Maple Scale in Oregon.

I send you to-day under another cover a specimen of a Scale or Bark Louse that is infesting some of our trees here. The specimen sent is taken from the soft maple. I am inclined to think that it is the Maple Scale; but its appearance and habits answer completely those given of the Cottony Cushion Scale, and do not answer those given of the Maple Scale. The color of the eggs of these are pinkish, and I have never found them on the leaf, but always upon the stem or limb of the tree. They infest the Maple, Box Elder, Locust, Pyracanthus, and in fact nearly everything in the way of tree or shrub. I have thus far not been able to discover any serious effect upon the tree or shrub from their workings. Please advise me what they are, and oblige.—[E. W. Allen, Secretary Oregon State Board of Horticulture, Portland, Oregon, July 16, 1890.]

REPLY.—The insect which you send, and which is damaging your soft Maple shade trees, is the common Cottony Maple Scale of the East (*Pulvinaria innumerabilis*). It is somewhat below normal size, and the egg sac is narrower than usual. It spreads slowly, but is often extremely abundant and injurious. The remedies in use in Eastern cities consist of heading in the tree; *i. e.*, cutting off the branches, and in spraying by means of a double-acting force pump, mounted upon a tank cart, with the ordinary kerosene soap emulsion.—[July 23, 1890.]

The Wheat Straw Isosoma in the State of Washington.

We have discovered a worm in the stalk of our present crop of wheat which is unknown to us as farmers. The insect is found sometimes in the space between the joints, but oftener in the first joint from the ground. Our wheat fields have shown spots of poor grain in unaccountable areas to such an extent that we have sought for the cause. We have discovered this small worm to be very numerous, but it does not seem to be of any especial damage to the plants, as it is found in the healthy stalks equally with those of poorer growth. Would you kindly refer the specimens which I inclose to the Entomologist, and send report to Walla Walla Farmers' Alliance?—[Milton Evans, Secretary Northwestern Farmers' Alliance, No. 56, Walla Walla, Wash., July 17, 1890.]

REPLY.—The insect which is damaging your wheat fields is a species very closely related to the Joint-worm of the Eastern States. It is a species known as the Wheat-straw Isosoma (*Isosoma tritici* Riley). You will find this insect treated at some length in the annual report of this Department for 1881-'82, pages 183-187. Unless present in a wheat field in enormous numbers this insect damages the crop but little; but in case a remedy is desired, it may be found in burning the stubble after harvest, as the majority of the worms occur in the straw below the point of cutting. As most of the fields are allowed to grow up with the weeds after harvest, it will be an easy matter a little later to run a mower through the fields, and after the weeds are dried the whole surface of the field can be burned over.—[July 24, 1890.]

Supposed Enemy under Pear Bark.

Inclosed please find two bits of bark from a pear tree. The tree is at least twenty-five years or more old; it is an old-fashioned, mealy summer pear. There have been for years places where the bark has been off, and under it there looked to be a white stringy saw-dust. This morning I applied some of it to the examination of a 16-power pocket glass and found it to be worms, the longest being one-eighth of an inch long.

It has been known to cause the decay of many good trees for perhaps fifteen years in this neighborhood, because they all go just alike. The bark will begin to turn black in the crotch of the limbs, then about six inches from the crotch it will begin to decay, turning black first and then white, and in the course of three or four years the tip ends of the limbs begin to die nearly to the body of the tree. The limbs from the crotches up die on the upper side and seem to go from the outside to the center by sawing off and splitting them open. It is the first time that I have had a good sight at the worms, although I have watched the decay for several years. Do you recognize the worms?—[H. L. Jeffrey, Woodbury, Conn., July 23, 1890.]

REPLY.—I am of the opinion that the worms which you send have nothing to do with the decay of your trees. They are the maggots of a little fly of the genus *Sciara*, and are attracted, probably, by the decaying condition of the wood. You will therefore have to look further for the true cause of the injury.—[July 24, 1890.]

GENERAL NOTES.

DAMAGE BY TOXOPTERA GRAMINUM.

Colman's Rural World, of St. Louis, called attention last June to the extraordinary abundance of this plant-louse in the vicinity of St. Louis. The oats for 100 miles in every direction were badly damaged, and in general it was predicted that hundreds of thousands of bushels of oats would be destroyed. The insect in question has acquired the popular name of the "Texas Louse," which seems very appropriate, in view of its great abundance in Texas during the past two summers. It extends, however, as far north as northern Indiana.

AN EXPERIENCE WITH THE GIPSY MOTH.

We quote from the *Orange Judd Farmer* of July 5, 1890, an experience contributed by a Mr. J. O. Goodwin to the *Medford Mercury*: "I have had quite a little experience with the pest, as in the rear of my premises are three or four large apple trees which have been wholly uncared for by the owner, and the Tent Caterpillar and Gypsy Worm have held high carnival there until every vestige of green has disappeared. After devastating my neighbor's trees they *marched in myriads* for my premises, fairly covering the fences, houses, outbuildings, grass-land, currant bushes, and concrete driveways with their trooping battalions. I immediately tacked tarred sheathing paper around every one of my trees and keep the paper well coated with printers' ink. The worms will not go over the printer's ink if care is taken to make frequent application of it. Experience, the best of teachers, proves it. During the past week or ten days I have personally attended to the matter and have killed millions of Gypsy Worms which have congregated below the paper on my trees. The trees nearest my neighbor's land were the first ones attacked (they will not pass a tree), and five or six times a day the trees below the paper are literally covered with thousands of worms, notwithstanding I take great care to kill every worm seen at each inspection,

while not a worm can be found on the tree above the application of printers' ink. The number of worms cultivated on the three or four worthless trees on the premises adjacent to my own is astonishing; numbers fail to convey an adequate idea. The grass-land and the earth seem to be covered with them. In fifteen minutes after killing every worm to be seen on the trunk of the tree below the tarred paper hundreds can be found making their way up the trunk, to be stopped by the application of printers' ink."

ANOTHER NEWSPAPER SPIDER-BITE SCARE.

*"Bitten by a spider—Harry Mattoon, of the Central House, has a close call.—*Dr. J. H. Karsner yesterday was called to attend Harry, the second son of Mrs. S. V. Mattoon, and about sixteen years old, at the Central House, who on Tuesday night had been bitten on the fleshy part of his thigh by a black spider.

"The doctor says that as soon as the young man was bitten his leg began to swell and pain him fearfully. At times he was unconscious.

"A doctor was sent for to Moore's Station, and he attended young Mattoon that night, but as the swelling had not subsided in the morning and his suffering was very great, Dr. Karsner was sent for.

"The doctor told the Mercury reporter that young Mattoon's condition was a very serious one. His leg was swelled to great proportions as far as the knee, and it was so hard that he could make no impression in the flesh with his hand. But when he left the patient was better, and he thinks he will recover."—*Oroville Mercury, July 11, 1890.*

REMEDIES FOR THE HARLEQUIN CABBAGE-BUG.

Two of our correspondents, the one in Gregg County, Tex., and the other in Natchez, Miss., have suffered considerably from the damage done by this well-known pest. The gentleman from Texas writes that after exhausting his patience in endeavoring to hand-pick the bugs he finally hit upon the plan of sprinkling the plants with lime in the morning when the dew was on. The first application did not entirely rid him of the bugs, but a second and third about ten days or two weeks apart were successful. He commenced using the lime about the first of August, and following his example some of his neighbors tried it successfully. The lime was sprinkled on so that the plant appeared tolerably white without being affected.

Our Mississippi correspondent reports that he found the bugs hibernating in the neighborhood of fences among the thick Bermuda grass, and that in April he found them for the first time in the cabbage fields. They were at that time, however, comparatively few in number and confined to restricted places. They were evidently the first brood after the hibernating individuals, and by careful searching our correspondent entirely rid his fields for the season by sacrificing four or five dozen cabbages, cutting them down when they were only half grown.

THE SPIRACLES OF HYMENOPTERA.

The investigations of M. G. Carlet have recently shown that the spiracles of Hymenoptera are provided with a peculiar organ for closing and opening them which has been hitherto overlooked.

The spiracles of insects are, for the most part, capable of being closed in various ways. This is effected by the sides being caused to approach each other or by the action of a single or double lid or lips. The spiracles of these classes are provided with an internal muscular apparatus, by means of which the insects can exclude or admit the air at will. In other cases, however, the opening in the spiracle is rigid, and is commonly protected from the entrance of extraneous matter by the presence of simple or plumose hairs on the edge of the opening. The spiracles of Hymenoptera previous to Carlet's studies have been considered to belong to the latter class, and this is true of the external opening. It was found, however, in the first instance in the case of the anal spiracle of the bee,* and afterwards† to be true of all the spiracles of Hymenoptera, that the closing was effected not at the mouth of the spiracle, but a short distance below it on the trunk of the trachea, thus forming a small cloaca-like cavity. The closing is effected by means of a chitinous flap or operculum, which in its normal position forms a portion of the wall of the enlarged cavity immediately below the spiracle. By the action of a special muscle this flap may be drawn backward so that it crushes in the wall of the trachea and closes it much as a rubber tube may be closed by bending it at an angle. This form of shutting out the entrance of air into the trachea is given the name of the operculate closure (*fermeture operculaire*). The dissection of this tracheal muscle is a matter of extreme difficulty, as it is smaller than the finest thread of silk and is confused among the bundles of the other muscles which surround the stigmata.

MOUTH PARTS OF THYSANOPTERA.

A peculiar asymmetry of the head and mouth parts of Thysanoptera, which seems to have been hitherto overlooked, is described and figured by Prof. H. Garman in Bulletin of the Essex Institute, Vol. XXII, Nos. 1-3, 1890. A well-developed organ supposed to be a mandible is found to occur on one side of the head and to be represented by a mere rudiment on the opposite side, and that is accompanied with a lack of symmetry in the clypeus labrum, and also in the chitinous endocranium of the head. The long styliferous organs heretofore taken for the mandibles are supposed to be rather the laciniae of the maxillae. The explanation of the organs is given with some hesitation by the author, his studies having been limited to species in two genera.

* Comptes Rendus, November 5, 1888.

† Comptes Rendus, April 23, 1889.

ENTOMOLOGICAL SOCIETY OF WASHINGTON.

OCTOBER 2, 1890.—Messrs. J. M. Stedman, Nathan Banks, and F. W. Mally were elected members of the Society.

Under exhibition of specimens and notes, Dr. Fox exhibited a specimen of a small spider, belonging to the genus *Episinus*, which was stated by Dr. Marx to be an undescribed species.

Dr. Marx called attention to two spiders new to our fauna, one belonging to the European genus *Histopona*, taken at Penn-Mar, Md., and also received from South Florida, and the other a new genus of uncertain position, but possibly allied to the Agelenidae, represented by a single specimen taken on the grounds of the Department of Agriculture.

Mr. Marlatt exhibited a specimen of *Trypeta equalis* Lw. which he had bred from the seed-pods of *Xanthium* and the larval habit of which he had described at a previous meeting of the Society.

Mr. Marlatt then presented a paper on "Some Observations on the Habits of *Vespa germanica* and *V. cuneata*." The feeding and nesting habits, particularly of the first-named species, were described. Three kinds of nests were mentioned, viz, the very rare aerial ones, those beneath stumps or stones and those in open ground, the latter being much the more common. Various insect and mammalian enemies of these wasps were alluded to, together with the means employed to destroy the nests when their proximity to dwellings renders them objectionable. Discussed by Messrs. Howard, Schwarz, Fox, Dodge, Stedman, Marlatt, and others.

Mr. Howard read a paper entitled "A New Remarkable Genus of Encyrtinae," in which he characterized a new genus and species which possesses the peculiar ramose antennae, hitherto peculiar in the subfamily Encyrtinae, to *Tetracnemus diversicornis* of Westwood. Mr. Howard has named the genus *Tanaostigma* and the species *T. coursetiae* from *Coursetia* (?) *mexicana*, a rare leguminous plant collected in the Alamos Mountains, Mexico, by Dr. Edward Palmer, and in the ovaries and stigma of which the insect breeds. Discussed by Messrs. Schwarz, Howard, and Marlatt.

Dr. Marx gave an interesting account of his recent experiments to determine whether the bite of *Lathrodectus mactans* is poisonous or not. He described the poison glands of *Lathrodectus* which are remarkably small. He had introduced the poison in various ways into guinea-pigs and rabbits without obtaining any satisfactory results, and proposed to vary and continue his experiments to put the matter of the supposed poisonous nature of the bite of this spider, if possible, beyond doubt. Discussed by Messrs. Schwarz, Howard, Fox, and Marlatt.

Mr. Ulke, who was present, gave an interesting description of the habits of *Tachys incurvus* Say, which he had found in numbers in the nests of ants, and which is the first *Carabid* to be determined as truly myrmecophilous. He also described the habits of certain myrmecophilous Staphylinidae, and exhibited a small collection of Coleoptera made by Mr. T. Ulke, illustrating the local fauna of the Black Hills district. Discussed by Messrs. Schwarz, Howard, and Marx.

In connection with the subject of local faunas, Mr. J. B. Smith's recent catalogue of the insects of New Jersey was taken up and discussed at length by the Society.

Mr. Townsend communicated for publication a generic synopsis of the first five groups of the North American calyptrate Muscidae.

C. L. MARLATT,
Recording Secretary.

SPECIAL NOTES.

The Texas Screw Worm.*—Prof. H. A. Morgan has put together some original matter on the subject of this plague to Southern cattle (*Lucilia macellaria*) in a recent bulletin of the Louisiana Station. It seems that some animals were purchased for the purpose of investigation, and direct observations upon the insect were made. Popular descriptions are given of the egg, larva, pupa, and imago, and observations are recorded which prove that the insect will breed upon decaying animal matter. The statement is made that they will breed in decaying vegetable matter also, but the observations proving this statement are not recorded. The fly is said to be readily attracted by the odor of both decaying animal and vegetable matter, and the author has seen plants in the neighborhood of a dead animal completely covered with the flies. The fly is said to be more or less active at night, and the author urges the necessity of mosquito bars in localities where the Screw-worm Fly is prevalent, as it is well known to attack human beings.

All the natural openings of animals are said to be most liable to attack, particularly the "sheaths" of horses and mules and the navels of newly-born stock, while in all animals where an abrasion of the skin is made the fly may be expected to lay her eggs. The death of stock which has been attacked at the point where the horn has been accidentally broken off is recorded, but the majority of deaths resulted from the deposition of eggs upon spots where ticks had been killed, the fly being attracted by the blood. The author had noticed, however, that when sheep had become sick and emaciated, the characteristic sickly odor has attracted the flies, which laid masses of eggs in the folds of the wool, the young larvæ penetrating the skin where no wound has been made.

In the matter of preventives, the author insists upon the importance of burying or otherwise destroying all animal and vegetable matter, a

* Bulletin of the Agricultural Experiment—Station of Louisiana, No. 2, Second Series. Texas Screw Worm, by Prof. H. A. Morgan, Entomologist, Baton Rouge, 1890.

depth of from 2 to 2½ feet being necessary in case of burying, and he suggests also that all refuse on common dumps be disinfected. Anything that will prevent the stock from abrasions of the skin is a preventive, and the statement is made that the barbed-wire fence and the Screw-Worm Fly go hand in hand. In the matter of remedies, a long list of substances has been experimented with, and it will be unnecessary to mention them in detail, as but one is unhesitatingly recommended. This is crude carbolic acid. When the maggots have been eliminated from the wound the latter should be washed thoroughly with warm water and dressed with carbolized oil (1 part carbolic acid, 16 of oil). If there is a cavity, lint cotton saturated with the oil should be inserted. Tar, grease, and fish-oil are recommended as ointments. The common use of mercurials is deprecated on account of the danger of the animal licking the parts.

We are sorry to see that the author has not experimented with pyrethrum, which is useful in destroying the worms and particularly in causing them to forsake the affected parts. Our first specimens of this worm were sent us back in the sixties as abounding in the refuse of osage orange fruit from which the seed had been abstracted, and Mr. Morgan's experience corroborates this vegetal-feeding habit in a species normally sarcophagous and helcophagous. We have long been interested in this insect, and are pleased that Mr. Morgan has so thoroughly covered the ground in his little bulletin, which, by the way, is stated to be preliminary in its nature. It is a valuable contribution to the somewhat extensive literature on the subject, which for the most part concerns the insect's relations to man rather than to live-stock, and we wish that he had omitted the perfectly ridiculous figures of the insect, which serve no other purpose than to prejudice the character of the text.

Physiognomy of the American Tertiary Hemiptera.*—Mr. S. H. Scudder has just published under this caption a very interesting contribution to the paleontology of entomology. An interesting comparison is drawn between the fossil Hemiptera of Europe and America (including the species found in amber), showing that 266 species have been found in American strata as against 218 in European strata. A number of striking generalizations are made, from which it appears that the general facies of the Hemipterous fauna is American; that all the species are extinct; that no species are identical with any European tertiary forms; that a very considerable number of genera are extinct; that existing genera which are represented in the American tertiaries are mostly American, not infrequently subtropical or tropical American, and where found also in the Old World are mostly those

*Author's extras from the Proceedings of the Boston Society of Natural History, vol. xxiv, 1889, pages 562 to 579.

which are common to the north temperate zone; that there are no extinct families; and that the appearance of the same families and even of the same groups of genera in the European and American tertiaries is common, but of the same restricted genus very rare.

Catalogue of the Insects of New Jersey.*—In a handsome volume of 485 pages Professor Smith has given us a list of all the insects which are recorded from the State to which his labors have been recently transferred. The catalogue is the result of only a few months' labor and is confessedly very incomplete. In fact, as the author states, except in Coleoptera and Lepidoptera, New Jersey is practically unexplored, and even in the collected orders northern and northwestern New Jersey are entirely unrepresented. The only general collection the author was able to consult was that of Mr. M. S. Crane, of Caldwell. We marvel at and admire the author's great industry, but feel that in this case it has been prematurely applied and that further time and collecting would have resulted in a catalogue more satisfactory to himself and to entomologists generally. In its present shape it will be of very slight avail to the student of faunal distribution, except, perhaps, in the two orders above mentioned. Six thousand and ninety-eight species are mentioned, of which 2,227 are beetles, 1,074 butterflies and moths, 1,140 Hymenopterous insects, and 811 two-winged flies, the other five orders being very poorly represented.

Economic Entomology in New South Wales.—The Government of New South Wales has just begun the publication of a journal entitled *The Agricultural Gazette of New South Wales*, issued by direction of the Hon. Sydney Smith, M. P., Secretary of Mines and Agriculture, the first number of which was published in July of the present year. The Director of Agriculture, Mr. H. C. L. Anderson, has sent us the opening number, which is a very creditable pamphlet of 154 pages and in which we are pleased to see that the subject of insect pests receives a great deal of attention. Our esteemed correspondent, Mr. E. Sidney Olliff contributes three articles to this number, entitled, respectively, Insect Pests (a consideration of the Codling Moth and Apple-leaf Roller), Insect Friends and Foes, and the Maize Caterpillar and Moth (*Heliothis armigera*). The first and the last of these articles are each illustrated by a well executed heliotype plate reproduced in part from the reports of this Department, and, what with the work being done by Mr. Olliff at Sydney, Mr. Crawford at Adelaide, Mr. Tryon at Brisbane, and Mr. French at Melbourne, the Australians are making rapid advances on the practical side of entomological study.

*Catalogue of insects found in New Jersey. By Prof. Jno. B. Smith. From the final report of the State geologist, vol. ii, Trenton, 1890.

Root Galls of Australia.—Since the preceding notice was written we have received Part 2, Vol. 1, of the *Agricultural Gazette of New South Wales* (August, 1890) and are pleased to notice that it is devoted entirely to the consideration of an Anguillulid which damages potatoes, parsnips, mangels, and the roots of the peach. The subject is treated in a masterly manner by Dr. N. A. Cobb, the pathologist of the Department of Agriculture of New South Wales. A most careful study of the life history of the species involved is given and an analytical key to the species of the genus *Tylenchus* follows. Descriptions of the different species are then given and the final section of the paper considers the question of remedies. Dr. Cobb identifies the species with the one treated by Dr. Neal in Bulletin 20 of this Division and adopts Dr. Neal's provisional name of *Tylenchus arenarius*. He is unfamiliar with the paper by Prof. G. F. Atkinson published as No. 1, Vol. 1, of the "Science Contributions from the Agricultural Experiment Station, Alabama Polytechnic Institute" (reviewed in *INSECT LIFE* for March, 1890, page 263), in which this form is determined as identical with the European *Heterodera radicolica*, although Doctor Cobb admits that the species may be this latter, his uncertainty arising from the insufficiency of the description and from lack of literature. Doctor Cobb gives the results of no experiments of his own with remedies, but publishes a very concise and admirable summary of the recommendations of others, giving the greatest prominence to the trapping remedy proposed by Professor Kuhn on the basis of Strubell's investigations. He also devotes considerable space to the different means by which the disease may pass from one piece of land to another and in this connection the influence of a good system of surface drainage is brought out.

We congratulate the Director of Agriculture upon the publication of such an admirable paper.

Notes upon *Ephestia interpunctella*.—We publish in this number a note under the above heading by Mr. W. H. Patton, in which he arrives at the conclusion that *Ephestia interpunctella*, *E. kühniella*, and *E. zea* are all synonyms. We publish the note in deference to Mr. Patton's well known reputation as an entomologist, but can not do so without entering our strong dissent from his conclusions. We have long since adopted *zea* as a synonym of *interpunctella*, but fully believe in the distinctness of *kühniella*, though originally inclined to believe that they might prove synonymous. Full study confirmed us in the opposite view, and, while we do not attach great generic value to the differences, the fact that Mr. Hulst in his recent monograph of the Phycitidæ of North America has placed them in two different genera (*kühniella* belonging to *Ephestia* proper while *interpunctella* is placed in Guenée's genus *Plodia*, is certainly corroborative of their specific distinctness. The main difference between the two genera, as indicated by Mr. Hulst,

is that in *Ephestia* the palpi are erect while in *Plodia* they are porrect. The criticism concerning the larva shown at fig. 30, Vol. II, is equally unfortunate, as we have carefully studied the early stages of *interpunctella* and are equally familiar with those of *Gelechia cerealella*, the early stages of both species being represented in large series in the National Museum collection.

REPORT ON A LOCAL OUTBREAK OF GRASSHOPPERS IN IDAHO.

By LAWRENCE BRUNER.

LINCOLN, NEBR., September 1, 1890.

Prof. C. V. RILEY,

U. S. Entomologist, Washington, D. C.:

SIR: I submit herewith a brief report on my recent trip into the Northwest, for the purpose of investigating the reported locust or grasshopper plague in portions of Idaho, Montana, and Utah. The trip was made in company with Mr. T. H. Marsland, of this city, who acted as an assistant while in the field.

Respectfully,

LAWRENCE BRUNER,
Special Agent.

We left Lincoln on the 7th of August and proceeded to Soda Springs, Idaho, where the first stop was made. Here inquiry was made of the settlers as to any possible locust depredations within that immediate vicinity or in outlying regions. The country round about was also visited by us, and careful collections made of such locusts and other insects as were to be obtained. After three days had been spent in this work, and no locust plague discovered east of the Utah and Northern Railroad, either through report or by actual observation, we proceeded to Pocatello, Idaho. Here we remained a day, busying ourselves in interviewing various persons belonging to the immediate locality, as well as others who lived in Montana and other portions of the Northwest. Collections were also made in the valley of the Portnuff and among the foot-hills adjoining, but none of the destructive locusts were obtained.

During the day spent here a miner from Butte, Mont., was interviewed, who informed us that several weeks previously he had seen large numbers of grasshoppers in the vicinity of Red Rock Lake, Montana, and Henry Lake, Idaho, but was not certain as to the kind. His description of the insects, however, lead me to believe they were "natives," and not the much-dreaded Rocky Mountain Locust.

From Pocatello we proceeded westward to Shoshone, Idaho, the nearest point on the Oregon Short Line of the Union Pacific Railway, to the Camas Prairie of Logan County, Idaho, and where we had become pretty well satisfied the grasshoppers of which we had come in quest would be found. Upon arriving at Shoshone we accordingly began immediately to investigate, and soon found a number of specimens of

Camnula pellucida, which we were assured was the insect that was doing all the damage on the prairie and the entire farming region about. The few straggling hoppers that we found in the streets and among the fields along the railroads just outside of town were said to have been carried down from the regions above on the locomotive and cars running between Shoshone and Ketchum. Be this as it may, we were now certainly very close to a region invaded by a locust plague, either of local or foreign origin, but most probably the former.

On the following morning we arranged with several ranchers who were in from Soldier, a town situated in the prairie about 40 miles northwest of Shoshone, to accompany them to the region. The owner of the team was accordingly engaged to transport us across the lava-beds and intervening divide which separates Shoshone from the Camas prairie, or upper valley of the Malad River, an exceedingly beautiful and fertile valley through which flow many clear mountain streams. Like many of the other fertile valleys of the region bordering the great interior basin, this valley is the remains of an ancient lake that was produced at the time of the lava outflow, and afterwards drained by the wearing away by erosion of the comparatively narrow ledge of lava at its lower end.

About 22 miles out of Shoshone we stopped at a rancher's over night, and at his place found the first signs of the hoppers. Here we were taken over a meadow of about 80 or 100 acres in extent, which was pretty well covered with the *Camnula pellucida*, which we were informed had bred in the adjoining hills. These had not, however, done any great amount of injury, since they had not come down into the valley until quite recently, nor had they at any time during the summer shown much activity or voraciousness. Up to the time of our visit no eggs had been observed to have been deposited by them, and but few of the locusts were seen in copulation. Other small areas in the immediate neighborhood were infested by similar isolated swarms that had originated from stragglers which left the prairie during the summer of 1889, in small swarms that entered the hills in every direction. On the following morning we started across the ridge afoot for the next ranch, 6 miles away, while the team went around, about 20 miles. During this walk we encountered several small swarms of the same locust, all of which were observed to be gathering in the vicinity of water or meadow grounds. Some of these latter hoppers were copulating, but most of them were sitting singly or in groups upon the ground or vegetation. None of them appeared to me to possess the usual activity belonging to the species as I had seen it previously.

When we arrived at the ranch for which we had been making, the hoppers were found in large numbers all over the meadows and along the lower slopes of the cañon walls where the vegetation showed the presence of considerable moisture. Here, too, we noticed the seeming lack of activity among the hoppers. Nowhere did they exhibit that

voraciousness and desire to be on the move that I had been so often accustomed to see in them on previous occasions. After joining the team and proceeding up the valley towards the divide separating the Snake River plains from the Camas prairie, we encountered still other scattered swarms of this same locust. Some of these swarms were quite small, while others were of respectable size. All of them were confined to the valley or lower slopes of the foot-hills and showed a tendency to keep as close as possible to water or green vegetation. Just before reaching the divide a small swarm of them was encountered which appeared quite active, and which were engaged in depositing eggs. These were gathered on a low gravelly flat which covered possibly one-half an acre in extent. Only a small per cent. of the locusts thus gathered here were actually engaged in depositing eggs, and but few eggs had thus far been placed.

Beyond the divide, *i. e.*, on the prairie side, the locusts became quite general in their dispersion, but were by no means abundant until we arrived upon the prairie proper and came to the vicinity of fields of grain. Here they were everywhere, and their work of destruction became apparent on all sides. Fields of grain had been stripped to the bare soil in places, while the prairie grasses were greatly damaged. Even the weeds of the country occasionally showed their ravages. Some wheat-fields still had the bare stalks standing rigid, looking like so many porcupine quills stuck perpendicularly into the ground. Occasionally a field would be passed where but little damage had occurred. In but few instances, however, was the injury complete, for almost every farmer in the valley, so far at least as we visited it, had a portion of some or all of his crops spared by the ravaging hordes.

After establishing ourselves in the valley we soon began our work of investigation by inquiry and personal observation, and in this manner in two days had obtained a pretty thorough knowledge of the hopper, both for the past and present, with some notions as to its possible future also. We ascertained that it first made its appearance in numbers sufficiently great to attract the attention of the settlers about four years ago, when some injury was done to gardens, and here and there to fields of grain about the edges along road-sides. The following year larger areas were infested and more extensive inroads made into the cultivated crops. Even at this time no especial attention was paid to the enemy, for all the farmers and ranchmen had an abundance and did not miss the comparatively small per cent. which fell to the hoppers. Last year was a very dry one, and the greatly increased hordes of the locust soon worked their way through field after field, which they left almost bare. This, together with the scarcity of wild grasses upon the meadows and foot-hills, occasioned partly by the drouth and partly by the ravages of the locusts, very quickly attracted the attention of the settlers. Then, too, to make the ravages appear more complete, these depredations were followed by a very severe

winter, with deep snows and but little wind to bare the hill-sides, so that stock might secure feed.

Early in the summer of 1889, soon after the locusts attained their growth and became fledged, they left the valley for the foot-hills and mountains, where their eggs were left in great quantities in all available places. In this migration the prevailing direction taken by the hoppers was easterly, varying from northeast to southeast. A few of them also went to the north and south, according to the position they occupied upon the prairie in relation to the surrounding and adjoining hills and mountains. Instead of remaining upon the low grounds where there is moisture, they left for the apparently arid hill-slopes—a trait not usually supposed to belong to this particular species of locust. On the following spring, that is, the spring of 1890, the deep snows disappeared, and the young first hatched on the hill-slopes exposed to the sun's direct rays, the water ran off, and by the time the hoppers were grown was normal on the valleys and low ground, where it was in excess early in the season on account of the deeper snows than usual. Instead of continuing on their course away from the prairie, the hoppers now turned in their tracks and came back to the valley, with its greener grasses, moister ground, and fields of succulent grain; and here they have for the most part remained. This year eggs were deposited upon gravelly spots in the valley. In many cases these are of considerable extent, but usually do not cover an area of more than a few acres.

Such is the outline history of this particular locust outbreak as nearly as could be ascertained in so brief a time as we had at our command, and with so little opportunity to travel over the region embraced in the area overrun. This area now extends over a strip of country commencing at a point to the westward of Soldier, Logan County, about 30 miles and extending as far to the westward as Lost River and Birch Creek. It occupies a strip of country about 30 to 50 miles in width and about 140 miles in length. The place of greatest abundance appears to be that region usually called the Camas Prairie, on the Malad River and the valley of Wood River below Halley. These regions are shown approximately on the accompanying map of Idaho, which I inclose with the report.

As nearly as I could ascertain no efforts were made during the past four years to keep the insect in check or to prevent its ravages, save in a single instance. This was done by a Mr. Fred Hastings, who flooded his grain field while the hoppers were still quite small, with the result that as soon as he turned off the water and the fields began to dry the little fellows left. The reason why nothing was tried in the line of remedies is to be laid to discouragement on the part of the settlers, rather than to any other single reason. After we had been in the region and had talked with a number of the ranchmen they felt much encouraged and have decided to see what can be done since the General

Government has shown an interest in their afflictions. What they want is directions as to how to proceed, and they will do the work cheerfully and thoroughly as far as can be done in a hilly and mixed country by a small population.

NATURAL ENEMIES AND PARASITES.

Prior to this summer but few of the locusts appeared to be troubled by any insect or other enemy, nor have any been observed to succumb to fungus diseases, and perhaps but few to other contagious ailments. During the month of August and also near the close of July many of the hoppers were found to contain maggots of some *Tachina* fly, which eventually killed them. Some contained as many as three or four of these grubs each. Others were attacked by the locust-mite, while a host of them were captured by digger-wasps and robber-flies, these latter being exceedingly numerous in individuals at the time we were in the country. In looking over a number of fields and portions of the prairies we were surprised to see how many of the hoppers had really been destroyed by these agencies. In some localities as many as one half dozen dead were counted on a square yard; and taking the prairie over it was estimated that there were enough dead on the ground at the time to make one to each square yard. Aside from the insect enemies noticeable there were evidently many others at work in thinning out its ranks. Birds, fowls, and small mammals, together with the few reptiles that are native to the region also did much towards their diminution. In addition to all these there appeared to be some disease extant among the hordes, which rendered the victims sluggish of movement, and dark in color, containing a sort of viscid brownish substance throughout the body. A very large percentage of all the hoppers seen upon the prairies appeared to be affected in a greater or less degree by this disease. It was probably due to this disease that the majority of all the hoppers of the region owed their torpidity.

FUTURE OUTLOOK.

My impression, after having visited the region and having carefully looked over the entire field, is that this plague is rapidly on the decline, and that with ordinary climatic conditions but little fear need be entertained for the future. As we have observed, the locusts have become diseased the present year, numerous insects and other enemies are at work on them, and the eggs are for the most part laid in the valleys. Many of these egg-areas will be flooded with water from the ditches during this month so as to cause them to swell this fall, and the young will accordingly hatch earlier in spring, and can be handled with water when water is abundant, and before the grain has started much. Then, too, we must not forget to mention the almost miraculous appearance of toads that came so universally and numerous over the region during the past summer. Millions of these batrachians hatched

in the valleys and foot-hills wherever water stood in pools, and after they had feet began spreading over the country. These will, if they winter favorably and come out again in spring, of themselves be nearly sufficient to clear away a moderately extensive grasshopper plague.

Should the inhabitants then lend a hand and assist these natural enemies in their efforts to check the plague, the summer of 1891 will end the grasshopper plague in that part of the State at least.

Leaving Soldier we were driven 30 miles into Haley by W. T. Perkins, who was untiring in his efforts to aid us in securing all the knowledge available concerning the locusts in the prairie and surrounding country. From Haley we proceeded by rail to Shoshone and Boise City. At this latter point collections were made of the different locusts that were to be met with. Here the short-winged form of *Melanoplus flavo-annulatus* Thos., known as *Pezotettix enigma* Scudd., was taken in large numbers; in fact it was so common at one point that it had become a nuisance, if not a pest. But, as the species prefers open country to the cultivated fields and low meadows, it may never prove injurious to crops. Aside from this hopper several other locusts were also present in larger numbers than usual in the foot-hills back of town. None of the *Camnula pellucida* were found or reported within less than 25 or 30 miles to the eastward.

Aside from these insects it was noticed that the codling moth and the apple-tree aphid hold almost complete sway in the beautiful orchards with which the region abounds. Almost every apple and pear is punctured by the larvæ of the former, while the latter cover nearly every apple-tree in the city, and what is to be most regretted is that nothing is done to check these enemies. Thousands of bushels of valuable fruit fall to the ground and are permitted to lie there and rot and propagate the future broods of the worm. None of the "wind-falls" are gathered and fed to hogs or even dumped into the river.

From Boise City we returned to Pocatello, where we took train for Beaver Cañon, one of the points to be visited as indicated in the letter of instructions. Arriving at this latter place, we soon learned that locusts were not present in more than ordinary numbers either here or across the divide in the vicinity of Red Rock and Henry's Lakes. This we learned from a rancher and guide to Yellowstone National Park who makes his headquarters at Henry's Lake. He said the 'hoppers were not at all common about either lake, in fact hardly plentiful enough for fish-bait. After spending a day here we went south to Ogden and Salt Lake City, at both of which points collections were made.

Upon inquiry among the railroad men who pass through there, it was not thought necessary to proceed to Nephi, the seat of last year's grasshopper injuries. We accordingly started for home, stopping over one train at Cheyenne, Wyo. While here we were informed that there were a great many grasshoppers along the line of the Cheyenne and Northern, a branch of the Union Pacific Railroad. These locusts our informant

claimed were the old style migratory species which he had so often "herded off" the garden "when he was a kid." They cover a strip of country about 20 miles in extent, or from Uva to Wendover, near old Fort Laramie. He had not noticed them flying nor migrating; said they were quite plentiful, but nothing like when they visited Nebraska years ago. Had also noticed large numbers of the long-billed curlew among them all summer. Not having the authority to do so, we did not visit this region; hence can give no more detailed information concerning these insects than what has just been said.

Unless other swarms of locusts are present in portions of country not visited, there need be but little apprehension of invasions during next year. True, the extended drought for several successive years has been quite favorable generally to the increase of this class of insects, and we may expect local injuries at many points throughout the United States. But, as far as the migratory species are concerned, little danger is to be looked for.

ON THE USE OF CONTAGIOUS DISEASES IN CONTENDING WITH INJURIOUS INSECTS.*

By HERBERT OSBORN.

Four years ago I presented a paper before the Eastern Iowa Horticultural Society in which I discussed the possibilities of treating injurious insects by means of their various contagious diseases and the limitations which seemed to me must be recognized in such treatment. Further observation has impressed me with the correctness of the ground then taken, and the subject seems to me of such importance that I venture to bring it up here and repeat, in part, the substance of my earlier paper.

Considering the possibilities of the subject and the importance evident even after a brief study of it, it seems strange that these diseases have received so little attention as they have.

This may have been in part due to the fact that there seemed so little hope of making any practical use of such diseases, but, probably, more on account of the difficulties involved in the study and the lack of positive knowledge as to the nature of all diseases of an epidemic character. Of late years, however, and largely on account of the stimulus given to the study by the progress of the germ theory of disease, this subject has been claiming wide attention and is receiving extended study at the hands of a number of investigators.

While there can be no question that the subject has been too much neglected in the past, there seems at present some danger of the other

* Read before the Entomological Club of the American Association for the Advancement of Science, at Indianapolis, August 22, 1890.

extreme, or rather that from an exaggerated idea of what may be expected from this new means of contending with insects disappointment must inevitably follow, and then abandonment of a method which, taken in its proper limit, may prove of very great advantage.

It is my object in this paper to bring together some facts to show what may reasonably be expected from this source and to point out as far as possible the limits, as they appear to me, of its applicability.

Naturally the only diseases over which we can have any practical control, and which can therefore be encouraged at our pleasure, are those of a contagious nature, or we may probably say with safety those due to the spread and multiplication of specific disease germs.

Bearing this in mind three inquiries will naturally arise: First, what diseases have we as a basis upon which to work? Second, to what extent can we control, encourage, and disseminate such diseases, what limit will naturally surround their distribution, and what insects can be reached? Third, how will such methods compare in cost and effectiveness with other methods of destroying injurious species?

As regards the first point we are well aware of various diseases that attack and destroy many species of insects, some of the most common of which have been characterized under the names of Muscardine; Grasperie, Jaunes or Jaundice; Pébrine; Flaccidity, Flacherie or Schlaffsucht, and Foul Brood, as well as the various kinds of *Entomophthora* affecting flies, locusts, cicadas, and the Chinch Bug. These diseases are so well known and their characteristics have been stated so often that a repetition here is unnecessary. It may be stated, however, that careful descriptions of some of the most important are given by Prof. C. V. Riley in the Report of the United States Entomologist for 1885, and by Prof. S. A. Forbes in a pamphlet entitled "Studies on the Contagious Diseases of Insects;" also a summary of them in my paper already mentioned, Transactions Eastern Iowa Horticultural Society, in report Iowa State Horticultural Society for 1886, pages 400-405.

Summing up these diseases, I think no one will deny their great economic importance, on the one hand, as destructive agents to very important industries, such as sericulture and apiculture, and on the other hand as natural checks working more or less constantly as efficient agents in destroying insects of an injurious nature. Nevertheless, in order that our knowledge should give us a really practical advantage, it is necessary that it should provide us with means for controlling the multiplication and spread of the various forms so that we may prevent the destruction of insects of domestic value and encourage and hasten their action where used as agents in preventing or counteracting injuries of destructive species. It is exceedingly fortunate and profitable when a sudden epidemic carries off hosts of chinch-bugs or cabbage-worms, but until we can start the disease in localities where it is not at work, and carry it over from year to year so as to set it to work at our pleasure, we can not consider that our knowledge of the disease or

the germs producing it has reached the point of practical applicability. Let us see, then, to what extent these conditions have been met or are likely to be met by future investigation.

The investigations of Pasteur upon the pébrine, etc., of silk-worms and the measures recommended by him resulted in restoring the silk industry of France from a state of probable annihilation to a most prosperous condition. The same measures will protect the silk industry of the United States if it ever assumes important proportions, while there can be little doubt that measures equally effective must result from a knowledge of the foul brood of bees.* From this side, therefore, we can be assured of practical advantage from the studies of insect diseases. As regards the control of these diseases in the other direction there appears to be more difficulty. The disease appears, for instance, in a brood of insects that is present in great abundance and kills them off at a tremendous rate, until, perhaps, there is no material for it to feed upon, and it is checked by the destruction itself has wrought. How, then, shall the germ be preserved to start anew in subsequent years? Or the disease may be raging furiously on certain insects in one locality, while healthy insects in countless numbers may be causing their usual havoc in another. How shall the disease be transported and how can it be so spread as to quickly affect the insects?

To show how these conditions occur in practice I may be allowed to repeat briefly an actual trial in the direction of introduction of one form of disease. During the fall of 1883 I learned that the cabbage-worm disease was raging in Illinois, while at the same time healthy worms were plenty here, there being no evidence of disease. I at once wrote to Professor Forbes, asking him to send me some of the diseased worms. He did so, and in due time they arrived, and I at once placed some of the diseased worms on cabbage plants infested with worms, and also sprinkled some of the plants with water in which I had mixed fluids from the bodies of dead worms. Later I found one dead worm, apparently from effects of the disease. The cabbages being gathered sooner than I expected put an end to the trial out of doors, but I fed some worms in confinement upon cabbage leaves and exposed them to the disease. A number of these died with all the characteristics of the disease, and microscopic examinations showed them to contain the same micrococcus as recognized by Professor Forbes to be the specific form of this disease. Last fall, however, the disease commenced at a point very near where I started the experiment two years before, and spread rapidly until, during the latter part of the fall, cabbage worms all over the neighborhood were dying rapidly from its effects.

While it is unsafe to affirm that this resulted from the introduction two years previously, it is not improbable that such is the fact, and I

* A point which is now considered as fully reached.

feel considerable confidence that this disease may readily be transferred from place to place.

As to the possibility of preserving the germs from year to year, Professor Forbes has succeeded in one instance in carrying a species of micrococcus in culture-tubes over winter, inoculating with these the following summer and producing apparently the specific disease of that organism. We may consider, then, leaving out of the question the difficulties of the process, that it is *possible* to both hold the germs for a limited time and to start the disease anew in the same or another locality.

Admitting, however, the possibility of preserving and transporting the disease, we have still the problem of how to make the disease spread with that certainty and rapidity necessary to make it of practical value. Moreover, any remedy to be of general utility must be of such a nature as to be easily and properly applied by people unacquainted with the methods of germ-culture. It might be quite impracticable to send a trained bacteriologist into every county in a State to inoculate the chinch bug with flacherie.

The slowness with which the disease operates, even at best, makes it doubtful whether the method can ever be used where immediate results are desired. This is particularly true of all but the bacterial forms, and even with these a period of incubation must elapse after the first introduction, and a further period before the disease will spread from those first infected to other individuals. We can scarcely look to it, therefore, as a source of relief from sudden and unexpected invasions of insects. When successfully introduced its spread will depend upon a number of variable conditions, abundance of material upon which to feed, amount of communication among insects, atmospheric conditions, etc., so that final results would be uncertain. The application of such diseases may, therefore, be considered as limited to the power of preserving temporarily and introducing into different localities, and not embracing the power to regulate the conditions which control the spread of the disease once introduced.

Naturally such diseases spread most rapidly among gregarious insects and least rapidly among solitary species, and of solitary species most rapidly among those most numerous in individuals and least rapidly among those that are rare. The remedy, therefore, will be limited in general to wide spread gregarious insects or those occurring constantly or periodically in great numbers. Of these we may mention as examples the tent caterpillars, web-worms, cabbage-worms, chinch-bugs, locusts, May beetles, army worms, etc.

The final test will, of course, be the cost as compared with other remedies equally effective. But cost will depend almost entirely upon the time in which the results are desired. In a cabbage-patch the disease could be introduced in a single spot at slight cost, and in time it might spread over the entire patch. Or, if introduced so as to cover the en-

tire patch at once, the cost would probably be greater than that of some other remedies, but this might be more than compensated for in this case by effectiveness, since we are all aware of the difficulties of applying liquid remedies for this pest. With potato bugs, however, it is extremely doubtful whether any disease could be artificially introduced which would begin to compare with the arsenical applications when cost and efficiency are taken into consideration. To sum up, I think we are justified in the following inferences:

First. That there are diseases amply sufficient as a basis for economic work, the bacterial forms giving the most promise for all cases where early results are desired, while those due to fungi, so far as present knowledge goes, propagating slowly, can only be used as slow but efficient checks to injurious forms, the most we can do with them being to introduce them in localities where not already found.

Second. That the diseases can be controlled to the extent of preserving the germs for a season and transporting them from place to place to use for inoculation, but that its spread in nature will be affected by conditions beyond our control, while only such insects as occur gregariously or live in mingled hosts can be attacked to advantage.

Third. That the cost of application would prevent its adoption except in certain forms.

Finally, we must consider this method of contending with insects at best as but one of a number of profitable methods to be used in certain cases where other methods are insufficient and to supplement other methods where it can be done to advantage. With this end in view the diseases of insects are worthy of the most careful study, and will not, I think, disappoint us in their final results.

A NEW AND REMARKABLE ENCYRTID: IS IT PARASITIC?

BY L. O. HOWARD.

In September, 1890, Dr. J. N. Rose, of the Botanical Division of this Department, brought to the Division some herbarium specimens of the twigs and flowers of *Coursetia* (?) *mexicana*, Watson, a rare leguminous tree collected in the Alamos Mountains of Mexico early in 1890, by Dr. Edward Palmer. The plant was in full bloom, and fully half of the flowers had the petals pierced with a small round hole opposite the stalked ovary. The hole extended through into the ovary, which was abnormally swollen, and which was found to contain in many instances a perfect adult of a very abnormal Chalcidid just ready to emerge. Other unperforated flowers were examined, and in similar swollen ovaries the same insect in an advanced pupa state was found. Out of over fifty flowers which I examined I was unable to find one which was not infested in this peculiar way, and in one case the base of the pistil

was similarly swollen and contained another specimen of the insect. Dr. Rose however was more fortunate, and after some search found a single uninfested ovary, from which he was able to count the ovules and thus to identify the plant.

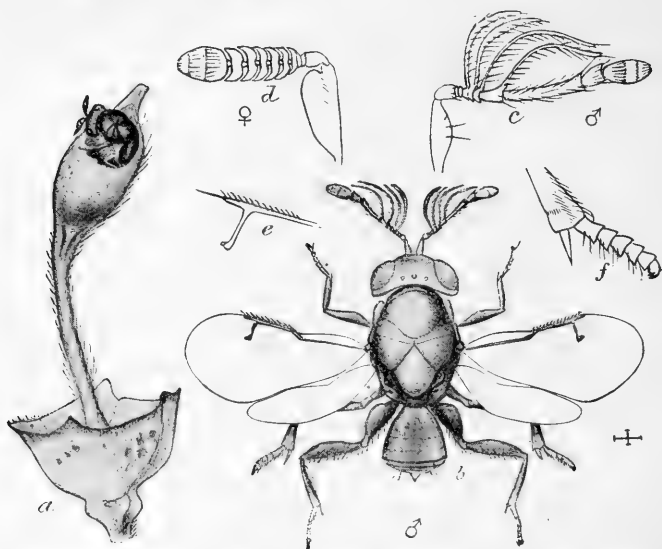


FIG. 20. *Tanaostigma coursetiae*: a, ovary of *Coursetia mexicana* with the *Tanaostigma* just issuing; b, adult male—enlarged; c, male antenna; d, female antenna; e, veins of fore wing; f, tip of middle tibia and tarsus—still more enlarged (original).

The specimens of the insect which had issued and were found in the papers which contained the plants were badly broken, and it was impossible to extract perfect specimens from the swellings, but from such as could be found it was at once evident that the insect was a very extraordinary Encyrtid, the large and undivided mesopleura, five-jointed tarsi, and the large mesotibial spur conclusively placing it in this subfamily.

Now, all the species of the Encyrtinae are parasitic so far as their habits are known, and consequently the most careful examination was made to decide whether some other insect had previously occupied the swellings. The cavities were uniform, with no apparent opening, and not a trace could be found, even upon microscopic examination, of any insect other than the Encyrtid. The pupal exuvium of this last was found, together with the characteristic little mass of excremental pellets discharged just before pupation, but nothing else. It is conceivable that the parasitic larva might have devoured its host "hide and hoof," but hardly conceivable that it should have eaten its excrement, yet of this not a trace was to be found.*

* Had this excrement been found, there would have been no difficulty in distinguishing it, as chalcidid larvæ void no faeces in the course of their growth, but only at the moment of transformation, when it invariably, so far as I have observed, takes the form of a few (6-12) rather large pellets, grouped together, and of a grayish color.

A series of cross sections was made of the stalk below the ovarian cavity to ascertain whether it had been burrowed by this or any other larva, with the result that the plant tissue below this point was found to be intact.

So far as appearances go, then, this Chalcidid is phytophagous rather than parasitic, yet from the perfect uniformity of habit in the subfamily to which it belongs this state of affairs is almost incredible. We must leave it for future field observations upon this species or upon some congeneric species to definitely settle this most interesting point.

Not alone from its habits, but also from its structure, is this insect of great interest. It is closely related to the abnormal and long-misunderstood genus *Tetracnemus* of Westwood, originally described in the *Mag-*



azine of Natural History for 1837, page 258, from the male sex only, and from a specimen captured upon oak in Coombe woods, in July, 1835. We reproduce here Westwood's figure of this abnormal insect, and it will be seen from the ramose antennæ that it closely resembles certain members of the subfamily *Eulophinae*. Walker in fact placed *Tetracnemus* in this latter subfamily, considering that Westwood had miscounted the tarsal joints in his species. Ashmead, however, on the strength of a species captured in Florida, has confirmed (*Proc. Entom. Soc.*, Washington, i, 203) the accuracy of Westwood's conclusion, as does also the form which we are about to describe, in so far as it shows that there are Encyrtinae with branched antennæ. Up to the present time, then, the only members of this great subfamily having this striking peculiarity are Westwood's *Tetracnemus diversicornis*, the undescribed species mentioned by Ashmead and the insect we are now treating, the latter possessing particular interest from the fact that we have the female sex, which is not known in *Tetracnemus*.

FIG. 21.—*Tetracnemus diversicornis*, male, enlarged (redrawn from Westwood).

TANAOSTIGMA* gen. nov.

Male.—Resembles somewhat closely *Tetracnemus* Westwood. Antennæ 11-jointed+2 ring-joints; scape with a slight expansion below, the expansion faintly serrate; pedicel one-third as long as scape, narrowed at base; joints 1, 2, 3, and 4 of the funicle (not counting ring-joints) each with a single long hairy dorsal apical ramus, each ramus bent forward and reaching to base of club; joints 1 and 2 short, subequal in length, and considerably broader than long; joint 3 one-third longer than 2; joint 4 rather more than twice as long as 3; joint 5 rather more than three times as long as 4, gradually widening towards tip; joint 6 a little longer than 4, gradually widening from 5; club oval, somewhat flattened, twice as long as joint 6 of the funicle and slightly wider, joints plain. Face sunken in and shriveled in death: ocelli forming a straight line. Mesocutum with a faint transverse, slightly oblique impressed line just anterior to

* Greek, Τάναος+στίγμη.

and almost parallel with the scuto-scapular furrow, and connected with this by a faint median longitudinal impressed line; scapulae just meeting at tip, the mesoscutellum therefore pointed anteriorly, rounded posteriorly. Wings hyaline, not ciliate; marginal vein long; postmarginal less than one-third as long as marginal; stigmal a trifle more than twice as long as postmarginal and descending almost vertically into the wing, the club bending abruptly outwards. Abdomen very short, almost truncate behind. Middle tarsi short, two-thirds the length of the short tibiae; mesotibial spur rather slender for this group, but longer than the first tarsal joint and acutely pointed.

Female.—Antennae with the same number of joints as in the male; scape with a rather broad leaf-like expansion below; pedicel short and rounded; flagellum broad, flattened, slightly clavate, the joints of the funicle all broader than long, convex basally, concave apically, gradually increasing in length and width from 1 to 6; club as long as the first four funicle joints together. Face short; cheeks scarcely rounded; antennal grooves very sharp; ocelli in a straight line or the middle one is very slightly anterior to the lateral ones. Thoracic and wing characters as in male. Abdomen punctate, turned upward at tip; ovipositor slightly extruded and pointed upward.

Tanaostigma coursetiae sp. nov.

Female.—Length 1.8^{mm}; expanse 4^{mm}; greatest width of fore-wing 0.64^{mm}. Head, face, thorax, and abdomen finely, closely, and evenly punctured. General color blue-black; palpi white; a narrow black band above mouth; just above this a broad yellow-white band extending across the face around the base of the eyes to a short distance behind the genae; above this a narrow black transverse band from eye to eye at base of antennae; above this a yellow-white band of about the same width, from eye to eye; antennal groove yellow-white; a light-yellowish spot behind the eyes and above the first-mentioned yellow band, and a narrow line of the same color across occipital margin between the eyes; propleura and mesopleura edged above and in front by a narrow yellowish band; antennae black; front coxae edged with yellowish-white; other coxae and all femora and tibiae black, lighter at joints; front tarsi dusky; middle tarsi yellow-white; hind tarsi yellow-white; last joint black, first joint dusky at base. Thorax and abdomen with sparse silvery scale-like pubescence, easily rubbed off.

Male.—Length 1.4^{mm}; expanse 3.2^{mm}; greatest width of fore-wing 0.62^{mm}. General color uniform metallic blue-black. Head, thorax, and abdomen very faintly shagreened, shining, almost smooth. Coloration of legs as in female.

Described from 3 ♀, 9 ♂ specimens, all more or less mutilated, taken from ovaries of *Coursetia* (?) *mexicana* collected in the Alamos Mountains, Mexico, by Dr. Edward Palmer.

NOTES ON GARDEN INSECTS.

By F. M. WEBSTER.

Pieris rapae was not observed during trip through southern Indiana in June of the present year, and did not appear about La Fayette until after the 10th of July. When it came, however, it was excessively abundant and was repeatedly observed ovipositing on cabbage displayed by grocers in front of their places of business in the most crowded portions of the city.

Spilosoma virginica.—Larvæ exceedingly abundant in June and was a serious cabbage pest. These larvæ were also very destructive to young peas, and were also observed feeding on the foliage of the gooseberry. During September, 1888, these caterpillars were observed feeding on the silk of corn and on the leaves of the cotton plant.

Mamestra picta.—Larvæ observed during September, 1888, denuding the ears of growing corn of their silk.

Agrotis saucia.—In St. Francis County, Arkansas, early in May, 1888, the larvæ were excessively abundant in fields of potatoes, where, in connection with the following species, they committed serious depredations by devouring the foliage. They did not appear to attack the stems, although at the same time, in gardens, they were cutting off both cabbage and tomato plants.

Prodenia lineatella.—On April 25, 1888, the larvæ were observed in considerable numbers in Teusas Parish, Louisiana, depredating upon young corn. They varied in length from one-fourth to a full inch, the smaller individuals being engaged in eating the parenchyma from the lower leaves, while the larger individuals seemed to have crawled up the plant and made their way down the "spindle" among the unfolding leaves, and were eating out elongate holes in those which were the youngest and most tender. The following day we found them engaged in riddling the leaves of cabbage in gardens. A few days later, in St. Francis County, Arkansas, associated with the preceding and in about equal numbers, they were ravaging fields of potatoes, not attacking the stalk, but eating every vestige of a leaf from them. On June 26 of same year, in the vicinity of La Fayette, Ind., several young larvæ were observed feeding on the parenchyma of the leaves of wheat in fields, and a few days later a much larger individual was observed eating into the head of an early set cabbage. Still later they were found on late planted corn feeding on the foliage.

Pionea rimosalis larvæ were observed near Mitchell, Lawrence County, destroying cabbage in the garden of Mr. J. A. Burton. They were abundant and working serious injury.

Silpha inaequalis.—While I do not present this as a garden pest, any facts relating to the vegetal food habits of members of this genus of beetles can not fail to be of interest. For myself, until this season, not a single member of the genus has been taken under circumstances which would indicate other than a diet of decaying animal matter. On June 18, in a small decomposing head of cabbage, in a garden, I found one of these beetles under circumstances which strongly indicated that it was feeding upon the diseased tissue.

Systema blanda.—In June of present year these beetles seriously damaged a small field of beets on the grounds of the Indiana Experiment Station by riddling the leaves with holes to such an extent that the foliage was well nigh destroyed.

Diabrotica vittata.—These beetles were excessively abundant the present season, and varied their usual food by devouring the silk of

corn. A common species of spider (No. 649) was observed to prey upon both this and the Tarnished Plant-Bug, *Lygus pratensis*.

Diabrotica 12-punctata.—As stated in my report for the year 1887,* the larvæ of this species sometimes become seriously injurious to young corn in Louisiana. In accordance with the suspicions expressed at that time, viz, that the species would soon be heard from farther north, the same habit and method of attack were the following year noticed in both Arkansas and Indiana. In the former State we observed the ravages of the larvæ in St. Francis County early in May, and in the latter State they were found in the fields of the experiment station on July 12. In Louisiana the depredations of these larvæ were studied in fields of corn, preceded the year before by a crop of cotton. In Indiana the field had been for several years devoted to timothy meadow, and had been plowed in the fall and again in June, some time before the crop (which was intended for the truck market) was planted.

When first observed at La Fayette, on July 12, the larvæ varied in length from 0.5^{mm} to 15^{mm} in length, the latter being, doubtless, nearly full-grown, as examples placed in a breeding-cage, fed for some time after and developed to adults August 2 to 5. Adults were observed pairing on August 9 and during the season until October; yet we failed to get larvæ originating from eggs from adults confined in breeding-cage, on growing corn, during this entire period. Nevertheless, as adult beetles and larvæ occurred simultaneously in both Louisiana and Indiana, it seemed probable that there are at least two broods North and possibly more in the South.

The largest larvæ observed were 15^{mm} in length, body gradually increasing in size from head to posterior extremity. Head small, brown above, darker at sides; jaws, dark brown; antennæ, white, three-jointed; head beneath, nearly white; mouth parts, other than the jaws, nearly white. On the head are many bristles, these being shorter and more closely placed in the vicinity of the mouth; eyes wanting. The three thoracic segments are shorter and better defined than the others, the first being coriaceous and yellowish-brown above. The legs, six in number, are nearly white, short, fleshy at base, and armed with short bristles. Encircling the base of each leg is a loop-shaped, dark line, with the stem of the loop extending upwards on the outer side to a small, poorly defined, semi-circular brown patch, whose base is formed by a distinct dark line. There are sparsely placed bristles on the body, the last segment of which is obtuse and provided beneath with a pair of tubercles or false prolegs and above with a circular brown leathery patch, which forms a conspicuous feature of *Diabrotica* larvæ. In this case the posterior margin of this patch is produced, forming a slight ridge and bearing a long, erect bristle. Color of body white, with tinge of yellow; wholly opaque.

* Report of Commissioner of Agriculture, 1887, pp. 148, 150. See, also, Mr. H. Garman, in INSECT LIFE, Vol. II, p. 179. 1889.

Of the food plants of the adult in the South I know but little. Its congener, *D. longicornis*, is very fond of the blossoms of the cotton plant, which may be also the case with this species.

Phorodon mahaleb.—This appeared at La Fayette the present season on potato vines, and several generations were reared from the infested plants.

Smynthurus hortense.—These active little insects were extremely abundant in Indiana the present season. About La Fayette I observed them feeding upon young cucumber-plants, the injured parts of plant not being affected by other insects or fungus. They were also reported by Mr. C. G. Boemer as injuring young tobacco in Switzerland County during the month of May.

SOME OF THE BRED PARASITIC HYMENOPTERA IN THE NATIONAL COLLECTION.

(Continued from p. 18).

Family ICHNEUMONIDÆ.

Subfamily Ichneumoninæ.

<i>Parasites.</i>	<i>Hosts.</i>
Ichneumon cæruleus Cr.....	Undetermined pupa (<i>Arctia</i> ?). St. Louis, Mo., April 4, 1872.
Ichneumon malachus Say.....	<i>Spilosoma virginica</i> F. St. Louis, Mo., April 17 and March 29, 1871; January 12, 1874.
Ichneumon subcæaneus Cr.....	<i>Spilosoma virginica</i> F. St. Louis, Mo., April. <i>Nematus ventralis</i> Say. Washington, D. C., August 2, 1886. Collected also in North Carolina, New York, New Jersey.
Ichneumon unifasciatus Say.....	<i>Acronycta oblinita</i> Sm. and Abb. St. Louis, Mo., 1870. <i>Arctia</i> sp. St. Louis, Mo., April 28, 1874. Received also from Wisconsin and Illinois.
Ichneumon puerilis Cr	Noctuid ? Washington, D. C., April 28, 1874.
Ichneumon rufiventris Brullé	<i>Pyrameis cardui</i> L. St. Louis, Mo., September 1870. Collected also in Virginia and Pennsylvania.
Ichneumon signatipes Cr.....	<i>Spilosoma virginica</i> F. St. Louis, Mo., June 6, 1867; September 1870.
Ichneumon lewisii Cr	<i>Arctia</i> sp. St. Louis, Mo., May 30, 1870.
Ichneumon jucundus Brullé.....	<i>Hadena devastatrix</i> Bracc. La Fayette, Ind., July 23, 1886. Collected also in District of Columbia, Virginia, and Montana.
Ichneumon pravus Cr.....	<i>Fidonia faxonaria</i> Minot. St. Louis, Mo., June 6, 1878.
Ichneumon wilsonii Cr.....	<i>Acronycta</i> on black birch. March 14, 1884.

<i>Ichneumon brevipennis</i> Cr	<i>Leucania albilinea</i> Guen. St. Louis, Mo., (?), July 28, 1876. Collected in Colorado.
<i>Ichneumon facetus</i> Cr.	Lepid. pupa. St. Louis, Mo., June 23. Collected in Virginia.
<i>Ichneumon leucopsis</i> Ashm.	Tortricid pupa on oak. Alameda County, Cal., March.
<i>Amblyteles subrufus</i> Cr	Hesperid pupa. Placer County, Cal. Collected also in Michigan.
<i>Amblyteles nubivagus</i> Cr	<i>Cucultha intermedia</i> Speyer. Washington, D. C., February 21, 1889. Collected also in Wisconsin.
<i>Trogus exesorius</i> Brullé	<i>Papilio asterias</i> F. St. Louis, several dates. Washington, D. C., May 8, 1883; May 10, 1883. <i>Papilio turnus</i> L. August 6, 1883. Collected in New York and Texas.
<i>Phæogenes ater</i> Cr.	<i>Egeria tipuliformis</i> L. Michigan. (C. M. Weed). <i>Egeria exitiosa</i> Say. Missouri, July 22, 1872. Collected in Wisconsin and Illinois.
<i>Phæogenes gelechiæ</i> Ashm	<i>Gelechia gallæ-solidaginis</i> Riley. New Hampshire, August, 1880. (Mary Treat.)
<i>Phæogenes exiguus</i> Cr	<i>Lophoderus velutinana</i> Walk. Missouri, June 24, 1886. Collected in Colorado.
<i>Phæogenes hemitiloides</i> Ashm	Saw-fly on <i>Betula nigra</i> . Washington, D. C., March 12, 1884.
<i>Phæogenes vincibilis</i> Cr.	Pyrilid on Thistle. Washington, D. C. Collected in Indiana.
<i>Phæogenes</i> sp.	Saw-fly on Black Birch. Washington, D. C., March, 1884.
<i>Centeterus sutularis</i> Ashm	<i>Chloridea rhexiæ</i> (?) West.
<i>Colpognathus euryptychiæ</i> Ashm.	<i>Euryptychia saligneana</i> Clem. July 5 and 18, 1884.
<i>Herpestomus plutellæ</i> Ashm.	<i>Plutella cruciferarum</i> Zell. Indiana.
<i>Dicælotus</i> sp.	Saw-fly on <i>Betula nigra</i> . Washington, D. C., March 15 and 28, 1884.

Subfamily **Cryptinæ**.

<i>Exolytus gelechiæ</i> Ashm	<i>Gelechia</i> on potato tuber. Alameda Coun- ty, Cal., November, 1887.
<i>Hemiteles thyridopterigis</i> Riley	<i>Thyridopteryx ephemereformis</i> Haw. St. Louis, Mo., Florida, and Georgia.
<i>Hemiteles thyridopterigis</i> var. <i>leucozo-</i> <i>natus</i> Ashm.	<i>Thyridopteryx ephemereformis</i> Haw. St. Louis, Mo., April 26, 1874.
<i>Hemiteles thyridopterigis</i> , var. <i>fuscus</i> Riley MS.	<i>Thyridopteryx ephemeraformis</i> Haw. Talu- lah, Fla., January 18, 1888.
<i>Hemiteles melitææ</i> Ashm	<i>Melitæa chalcodon</i> Bd. Alameda County, Cal., July, 1887.
<i>Hemiteles coleophoræ</i> Ashm.	<i>Coleophora</i> sp. Los Angeles County, Cal., July, 1886.
<i>Hemiteles variegatus</i> Ashm	<i>Bucculatrix</i> on Oak (<i>Q. agrifolia</i>). Alameda County, Cal., October 14, 1885. Collected in New York. (Lintner.)

Hemiteles selmæ Riley MS	<i>Aletia xyliua</i> Say. Selma, Ala., September, 1880. (Schwarz.) Dipterous root-gall on Oak. Cadet, Mo., June 21, 1885. Collected in South Carolina. (Atkinson.)
Hemiteles graciliaræ Ashm.....	<i>Gracilaria packardella</i> Chamb. Kirkwood, Mo., July 16, 1886.
Hemiteles bucculatricis Ashm.....	<i>Bucculatrix</i> on Oak. Washington, D. C., July 19, 1884.
Hemiteles cryptiformis Riley MS.....	<i>Acronycta betulæ</i> Riley. Maryland.
Hemiteles mesochoridis Riley MS	<i>Apanteles congregatus</i> Say, infesting <i>Philampelus pandorus</i> Hübn. Norwalk, Conn., August 3, 1887. Collected in Missouri.
Hemiteles mandibularis Prov	<i>Gracillaria purpuriella</i> Chamb. Kirkwood, Mo.
Hemiteles annulatus Ashm.....	Tineid pupa. Los Angeles, Cal., April, 1887.
Hemiteles columbiana Ashm	<i>Coleophora</i> sp. Washington, D. C.
Hemiteles hemerobicola Ashm	<i>Hemerobius</i> sp. Grand Ledge, Mich., July, 1881.
Hemiteles townsendi Ashm.....	Puparium of <i>Diptera</i> (<i>Muscid</i>). Washington, D. C., December 30, 1889. Collected also in Michigan (Townsend).
Hemiteles syrphicola Ashm.....	<i>Allograpta obliqua</i> Say, found on wheat. Washington, D. C., July 3, 1884.
Hemiteles alæfasciatus Riley MS	<i>Psyche confederata</i> G. & R.
Hemiteles sordidus Riley MS	<i>Orgyia leucostigma</i> A. & S. St. Louis, Mo.
Hemiteles periliti Riley MS	<i>Meteorus communis</i> Cr.? Washington, D. C., August 21, 1882.
Hemiteles rufiventris Riley MS.....	<i>Chrysopa</i> feeding on <i>Lecanium</i> on Pine. St. Louis, Mo., July 8, 1876.
Hemiteles minutus Riley MS	<i>Empretia stimulea</i> Clem. Washington, D. C., May 14, 1883.
Hemiteles ashmeadii Riley MS	<i>Phryganidia californica</i> Pack. Alameda, Cal., July.
Hemiteles laticinctus Riley MS.....	<i>Leucania unipuncta</i> . New Haven, Conn., June, 1880.
Phygadeuon pubescens Prov	<i>Nematus similis</i> Norton. Washington, D. C., February 14, 1880.
Phygadeuon walshiæ Riley MS.....	<i>Walshia amorphella</i> Clem. Fairbury, Ill.
Mesostenus gracilis Cr	<i>Dakruma coccidivora</i> Comstock. Maryland (?) July 24, 1880. Collected in Connecticut and Texas.
Mesostenus thoracicus Cr	Pyralid on Hickory. Kirkwood, Mo. Collected in New York, Virginia, Michigan, Texas, and District of Columbia.
Mesostenus albomaculatus Cr.....	<i>Crambus</i> sp. Texas (Belfrage). Collected in New York.
Mesostenus arvalis Cr.....	<i>Polistes</i> sp. Kansas, September, 1872. Collected in Texas.
Cryptus alamedensis Ashm.....	<i>Lepidopteron</i> . Alameda County, Cal., April, 1887.
Cryptus americanus Cr.....	<i>Pyrrharcia isabella</i> Abb. & Sm. May, 1882. <i>Grapta comma</i> Harr (Westcott). Collected in Texas, Virginia, Illinois, and Colorado.

<i>Cryptus mundus</i> Prov	<i>Crambus vulgivagellus</i> Clem.
<i>Cryptus nuncius</i> Say (<i>C. extrematis</i> ?)....	<i>Platysamia cecropia</i> (L). Missouri, May, 1868; Nebraska, July and August, 1885, and June, 1889; Brookings, Dak., June 18, 1889; Philadelphia, Pa., 1882. <i>Callosamia promethea</i> Drury. Collected in Texas.
<i>Cryptus bellus</i> Cr.....	<i>Tolyte vellida</i> Stoll. New York (Fuller).
<i>Cryptus extrematis</i> Cr	<i>Bombycid</i> ? on <i>Gnaphalium</i> . Bluffton, S. C., December 4, 1889; February, 1890.
<i>Cryptus ultimus</i> Cr.....	Willow swellings (<i>Euura s.-nodosa</i> Walsh). St. Louis, Mo., January, 1872.
<i>Cryptus</i> sp.....	Saw-fly on Black Birch. Washington, D. C., March 12-15, 1884.
<i>Cryptus atricollaris</i> Walsh	Leaf-roller on Plum.? St. Louis, Mo. Collected in Missouri and Illinois.
<i>Cryptus carpocapsæ</i> Riley MS.....	<i>Carpocapsa saltitans</i> Westwood? in seeds of <i>Euphorbia</i> . Mexico, August 29, 1887.
<i>Cryptus cyaniventris</i> Riley MS	<i>Hydrocampa proprialis</i> Fern.? on Water Lily. Florida, March 26, 1888.
<i>Orthopelma americana</i> Riley MS.....	<i>Rhodites</i> galls on wild rose. West Cliff, Colo., March 25, 1888.
<i>Orthopelma bedelliæ</i> Ashm.....	<i>Bedellia somnulentella</i> Zell. St. Louis, Mo., October 24, 1870.
<i>Orthopelma minutum</i> Ashm	<i>Rhodites erythrogaster</i> galls. Jamaica Plains, Mass., May 21, 1884.
<i>Orthopelma occidentalis</i> Ashm	<i>Rhodites similis</i> Bass. gall. Salmon City, Idaho, November 28, 1883. Collected in Montana.
<i>Orthopelma rosæcola</i> Ashm.....	<i>Rhodites ignota</i> O. S. gall. Pariah, Utah, April 25, 1882, and June 15, 1882.
<i>Orthopelma americanum</i> Riley MS.....	<i>Rhodites ignota</i> O. S. galls. West Cliff, Colo.
<i>Orthopelma californicum</i> Ashm	Rose gall. Alameda County, Cal., May, 1887.
<i>Catalytus pallipes</i> Ashm	Saw-fly larvæ, external parasites. Washington, D. C., May, 1881.
<i>Stibentes pettitii</i> Cr.....	<i>Bucculatrix</i> found on stone. Virginia, April 5.
<i>Stibentes gentilis</i> Cr	<i>Leucania unipuncta</i> Haw. August, 1875.
<i>Pegolochus bucculatricis</i> Ashm.....	<i>Bucculatrix</i> on Beech. Washington, D. C., April 18, 1884.
<i>Pezomachus minimus</i> Walsh.....	<i>Leucania unipuncta</i> Haw. August, 1875.

Subfamily **Ophioninæ**.

<i>Ophion macrurum</i> Linn.....	<i>Telea polyphemus</i> Cramer. March 18, 1882. May 8, 1874. <i>Platysamia cecropia</i> L. Missouri. October 3, 1869. <i>P. cecropia</i> L. (Treat). <i>Apatelodes torrefacta</i> Sm. (?) Virginia, July 3, 1884. Collected in D. C. August 27, 1878.
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- Ophion arctiæ* Riley MS. *Pyrharcia isabella* Abb. & Sm. Thomasville, Ga., February 12, 1879.
Epantheria scribonia Stoll. Columbia, S. C., February 8, 1879.
Hyperchiria io Fabr. by Mrs. Treat. Collected in Alameda County, Cal.
- Ophion bilineatus* Say *Viburnum* Noctuid (*Glæa* [*Orrhodia*] *in-ulta*? Grt.) Virginia, April 22, 1885.
Agrotis morrisoniana Riley. Washington, D. C., January 14, 1881.
 Collected in Texas, Missouri, Custer County, Colo., Michigan, Louisiana, Montana, and Florida.
- Ophion purgatus* Say *Mamestra trifolii* Rott. Parksville, Mo. July 10 and August 12, 1876.
Cælodasys unicornis Abb. & Sm. Missouri, July 10, 1871.
 Lepidopterous larva.
 Dipterous *Solidago* gall. St. Louis, Mo. Noctuid. Alameda, Cal., July 28, 1885.
 Collected in Virginia, Arizona, Selma, Ala.
- Ophion glabratus* Say *Hyphantria cunea* Drury. July 22, 1880.
- Thyreodon morio* Fabr. *Sphinx coniferarum* Abb. St. Louis, Mo. ?
 Collected in Connecticut, Missouri, District of Columbia, Massachusetts.
- Anomalon flavicorne* Say *Geometer* on Black Oak. St. Louis, Mo., June 7, 1876.
- Anomalon apicola* Cr. *Leucania albilinea* Guen. Lawrence, Kans., September 23, 1876.
 Collected in Florida, Texas, Missouri. ?
- Anomalon exile* ? Prov. *Platysamia gloveri*? Strecker. Fairbury, Ill.
 Collected in New York.
- Opheltes glaucopterus* Linn. *Cimex americanus* Leach. South Dakota.
- Agrypon puparum* Ashm. Noctuid pupa. Alameda County, Cal.
- Charops tibialis* Cr. Tortricid ?
- Charops* sp. *Melitæa anicia* Doub. Placer County, Cal. July (?), 1887.
- Charops apaturæ* Riley MS. *Apatura clyton* Bois.-Lec. Fairbury, Ill.
- Exochilum acronyctæ* Riley MS. *Acronycta hastulifera* A. & S. on Alder. Virginia, June 8, 1883.
Acronycta lupina Behr. Placer County, Cal., May 30, 1886.
- Exochilum tenuipes* Norton. *Spilosoma virginica* Fab. St. Louis, Mo., May 31, 1867.
 Collected in Texas and New Jersey.
- Heteropelma datanæ* Riley *Datana* on Walnut. Washington, D. C., August 19-21, 1880.
- Heteropelma flavicorne* Brullé *Datana* on Witchhazel. Washington, D. C., September 2, 1881.
- Campoplex assitus* Norton Noctuid ? Los Angeles, Cal. March.
 Collected in Vermont.
- Mesochorus americanus* Cr. *Microgaster* cocoons. Washington, D. C., September 1, 1882.

- Mesochorus obliquus* Cr.....*Euchaetes egle* Drury. Maryland, February 12, 1884.
Collected Washington, D. C., September 1, 1882.*
- Mesochorus scitulus* Cr.....*Leucania unipuncta* Haw. Sheldon, Ill., August, 1881. Rutland, Ind., July 27, 1880.
- Mesochorus aprilinus* Riley MS*Apanteles congregatus* Say on *Phlegethontius carolina* L. Washington, D. C., October 20, 1880, and April 4, 1881.
Phlegethontius carolina L. (Secondary.) Washington, D. C., September 20 and October 21, 1889.
Microgaster utilis French on *Sphinx carolina* L. Washington, D. C., April 12-18, 1881.
- Mesochorus microgasteris* Riley MS*Microgaster* cocoon on *Empretia stimulea* Clem. May 14, 1883.
Microgaster cocoons. St. Louis, Mo., September 10, 1876.
- Mesochorus luteipes* Cr. var*Notodonta* on Aspen. Boscawen, N. H., July 18, 1883.
- Mesochorus* (?) *chrysopæ* Ashm.....*Chrysopa* cocoon.
- Mesochorus* sp.....Rotten grape berry. September 11, 1886.
- Meloboris* sp.....*Pyralid* on Nettle. Virginia, July 31, 1882.
Collected in Texas.
- Cremastus mellipes* Prov.....*Depressaria pulvipennella* Clem. Kirkwood, Mo.
Lepid. Rose leaf-roller. St. Louis, Mo. ?
Collected in Michigan.
- Cremastus retinæ* Cr.....*Retinia* (*R. comstockiana* Fernald) on *Pinus rigida*. Ithaca, N. Y., November 18, 1879.
Gelechia beneficentella Murt. Kirkwood, Mo.
Lepid. Stem borer in *Polygonum*. Kirkwood, Mo., August 19, 1884.
- Cremastus missouriensis* Riley MSLepid. larva ? Kirkwood, Mo.
- Cremastus cookii* Weed*Phoxopteris comptana* Fröhl. Lansing, Mich. (A. J. Cook.)
- Eiphosoma pyralidis* Riley MS.....*Pyralid* on *Solidago*. Kirkwood, Mo., May 12, 1885.
- Pristomerus mellæthorax* Riley MS.....*Pædisca scudderiana* Clem. Kirkwood, Mo., May 19, 1884.
- Thersilochus conotracheli* (Riley).....*Conotrachelus nenuphar* Herbst. New Jersey, May 26-28, 1870.
- Pachymerus* sp*Euryceron rantalis* Guen. on cotton. Boyce, Ellis County, Texas, July 24, 1888.
- Angitia pædiscæ* Riley MS*Anchylophora nubeculana* Clem. on apples. Ithaca, N. Y., March 23, 1877.
Lepid. on roots of grape. Fortress Monroe, Va., July 10, 1884.
Pædisca n. sp. Wals. on *Myrica cerifera*. Fortress Monroe, Va., July 2-10, 1884.
Collected in Texas.

* Has same label as preceding sp. (*M. americanus*) and was probably reared from same cocoons.

- Angitia* sp. *Thalpochares carmelitæ* (?) Morr. on *Gnaphalium*, Bluffton, S. C., January 7, 1870.
- Casinarina compressa* Cr. Lepid. larva. Hazlewood, Ohio, August 10, 1885.
- Casinarina major* Cr. Grape-vine larva. (Mrs. Treat.)
Collected also in Texas.
- Limneria rufa* Riley MS. *Aplodes* (*Synchlora*) *rubivora* Riley. South Pass, Ill., July 17, 1869.
- Limneria nigricincta* Ashm. Tenthredinid larvæ on black birch. Washington, D. C., March 12-15, 1884.
Tineid on black birch. Washington, D. C., April 14, 1884.
Collected also in North Carolina.
- Limneria nolæ* Ashm. *Nola* sp. on willow. Los Angeles, Cal., 1886.
Collected in Massachusetts.
- Limneria oxylus* Cr. *Leucania unipuncta* Haw. Huntsville, Ala. May 20, 1882.
- Limneria tibiator* Cr. *Plutella cruciferarum* Zell. Los Angeles County, Cal., April; St. Louis, Mo., July, 1870, December, 1871; Virginia, November 17, 1882; Rock Ledge, Fla., March 29-April 6, 1880.
Acrobasis indiginella Zell. Ames, Iowa, May 10, 1871.
Plusia brassicæ Riley. Washington, D. C., November 13, 1882.
Collected also in Texas.
- Limneria dimidiatus* Cr. *Gelechia gallæsolidaginis* Riley. La Fayette, Ind., March 25, 1887.
- Limneria annulipes* Cr. *Mamestra picta* Harr. Ottawa, Canada (Fletcher).
Gelechia pseudacaciella Chamb. on Locust. Washington, D. C., September 24, 1879.
Acrobasis indiginella Zell. Ames, Iowa, May 10, 1871.
- Limneria pterophoræ* Ashm. *Pterophora* on apple. Alameda County, Cal., August.
Collected also in Texas.
- Limneria fura* Cr. Tortricid (?). Crescent City, Fla.
Collected also in Texas.
- Limneria fugitiva* Say. *Euchætes egle* Harr. St. Louis, Mo., July, 1867.
Clisiocampa sylvatica Harr. St. Louis, Mo., ? May 19 and May 21, 1871, and June 17, 1883.
Anisota pellucida Abb. & Sm. St. Louis, Mo., September, 1876.
Acrobasis indiginella Zell.
Lepid. larvæ on grass. Washington, D. C., March 25, 1874.
Anisota rubicunda Fab. Missouri, December, 1872.
Collected also in Virginia.
- Limneria œdemasiæ* Ashm. *œdemasia concinna* Abb. & Sm. Washington, D. C., August 5, 1889.

Limneria oligiæ Ashm.....	<i>Oligia versicolor</i> Grt. Washington, D. C., July 19, 1884.
Limneria ephestiæ Riley MS.....	<i>Ephestia interpunctella</i> Zell. feeding on wax. Missouri, May, 1873. Noctuid pupa. Texas. (Belfrage).
Limneria lophyri Riley.....	<i>Lophyrus abbottii</i> Leach. Valparaiso, Ind., May and June, 1871.
Limneria euryptychiæ Riley MS.....	<i>Euryptychia saligneana</i> Clem. June 25, 1884.
Limneria gelechiæ Ashm.....	<i>Gelechia celtisella</i> Murtf. Kirkwood, Mo., August 19, 1884.
Limneria argentifrons Cr.....	<i>Crambus zeellus</i> Clem. Indiana, June 14?, 1886.
Limneria dubitata Cr.....	<i>Laphygma frugiperda</i> ? Abb. & Sm. In- diana, October 9, 1884. Collected also in Massachusetts and Texas.
Limneria solenobiæ Ashm.....	<i>Solenobia walshella</i> Clem. Kirkwood, Mo., April 27, 1887.
Limneria euuræ Ashm.....	<i>Euura</i> sp. on willow. Pariah, Utah, April 16, 1887.
Limneria pattoni Ashm.....	Cocoon on cotton-leaf. Selma, Ala., Sep- tember, 1880.
Limneria eurycreontis Ashm.....	<i>Eurycreon rantalis</i> Guen. Cowley County, Kansas, July 6-9, 1888. Collected also in District of Columbia.
Limneria rufipes Prov.....	Tortrix on oak. Washington, D. C., Au- gust 19, 1884.
Limneria salicicola Ashm.....	Inquilinous Lepid. larvæ in willow gall, London, Ontario, March, 1872. Collected also in Texas.
Limneria cupressi Ashm.....	Dipterous gall on <i>Cupressus macrocarpus</i> . Marin County, Cal., December 6, 1885.
Limneria obliterated Cress.....	<i>Gelechia rubidella</i> ? Clem. Kirkwood Mo., October 15, 1881
Limneria noctuæ Ashm.....	Noctuid pupa found on black birch. Washington, D. C., July 12, 1884.
Limneria heliæ Riley MS.....	<i>Helia aemula</i> , on hickory, dead leaves of. Virginia, April 28, 1884.
Limneria nephelodis Riley MS.....	<i>Nephelodes violans</i> Guen. On grass. St. Louis, Mo., May 1, 1872.
Exetastes rufofemoratus Prov.....	<i>Agrotis alternata</i> Grt. Washington, D. C., October 21, 1884.

NOTES UPON EPHESTIA INTERPUNCTELLA (HÜBN.) ZELLER.

By WM. HAMPTON PATTON, Hartford, Conn.

Syn. *Ephestia kühnella* Zeller.

Syn. *Ephestia zea* Fitch.

In INSECT LIFE, Vol. II, No. 6, Dec., 1889, pp. 166-171, this insect is treated in an interesting article by Messrs. Riley and Howard. Two important errors occur, and should be corrected. Karsch had al-

ready shown that *kühniella* and *interpunctella* were only dimorphic forms of one species. The larvæ figured and described by Professor Riley as those of *interpunctella* (Fig. 30, *a b d*) are in reality those of the Angoumois Moth (*Gelechia cerealella*? Oliv.), with which they agree (see Report Commissioner Agriculture, 1884). That they do not represent *Ephestia* is shown by their not having the long bristles so characteristic of deltoid larvæ.

The dark form, INSECT LIFE, Fig. 30, should be known as *kühniella*, the light form, *ibid.*, Fig. 28, as *interpunctella* (*zœæ*).

NOTES UPON SOME INSECTS AFFECTING CORN.

By F. M. WEBSTER.

Clivina impressifrons.—Under date of June 11, 1890, I received from Mr. William E. Lawrence, of Whitley County, Ind., a considerable number of these beetles with the statement that "they were found in a piece of ground which had been broken the preceding spring, the field being swampy and of a black soil, like those infested by wire-worms. The beetles attacked the seed grains as soon as the latter became moistened."

When received one of the beetles had burrowed into a kernel of corn, in the vicinity of the germ, and was engaged in devouring the substance.

Ligyrrus rugiceps.—On April 25, 1888, this beetle was observed destroying corn in Tensas Parish, La., and on May 14 still greater numbers were observed working a like injury in St. Francis County, Ark. Considerable damage had been done by the pest in this last locality, and the beetles, at night, were literally swarming about the lighted lamps. In both instances the injury occurred on clay soils.

Euphoria sepulchralis.—This beetle was observed at La Fayette, on August 16 of the present year, eating into the kernels of corn, on the tips of ears, in the fields. Mr. L. O. Howard states that he observed this same insect depredating upon corn in the same manner in Georgia in 1881.

Sphenophorus ochreus.—The finding of eggs in the stems of *Scirpus*, growing in fields where the beetle was very abundant, and these eggs seeming to agree with those dissected by myself from the ovaries of females, would appear to indicate that the egg may be deposited in the stem of the plant after the manner of other species of *Sphenophorus*, and not always in the root.

Calocoris rapidus.—In a former report I stated that these insects were sometimes to be found attacking the kernels of ripening wheat. During the fall of 1888 they were observed at La Fayette, Ind., engaged in puncturing the exposed kernels on the tips of ears of corn, and ex-

tracting the milky substance. As many as ten individuals were observed thus employed on a single ear at the same time.

Nysius angustatus.—On November 2, 1885, we observed the sexes of this species in great numbers *in coitu* under *Euphorbia maculata*, and a week later obtained eggs from females taken at the time, and also found them under the *Euphorbia*. Prof. Herbert Osborn secured adults (pairing) and pupæ on November 15, 1887.* As neither Professor Osborn nor myself have observed adults in the spring, and my eggs did not hatch during the autumn of 1885, it would appear probable that the species winters over in the egg. I was absent from home during the spring of 1886, and lost track of the matter.

Orchelimum vulgare.—An adult male was observed September 4, 1888, engaged in feeding upon the substance of kernels of corn at tip of ears in field near La Fayette, Ind. In November, 1886, stalks of corn were received from Mexico, Mo., with that part below the tassel and above the upper joint fairly riddled with the egg punctures of *O. glaberrimum*. So numerous were these eggs that the farmers erroneously supposed them to cause sickness among horses fed upon the stalks.

EXTRACTS FROM CORRESPONDENCE.

The Green-striped Maple-worm.

I received the Bulletin from your Department for March, 1890 (Vol. II, No. 9, INSECT LIFE), containing my letter and your reply about the *Dryocampa rubicunda* (Maple Worms). Having some additional experience to give that I hope is worth something, I write again. Last year the worms appearing again as abundantly as before, we determined to see what could be done. So when the second crop of moths came we followed your advice and destroyed as many as possible, trampling them down as they came out of the ground towards evening. Then when they had hatched out and were still small, by the advice of Prof. W. A. Kellerman, of Kansas State Agricultural College, and Professor Tracy, formerly of this State University, now of Mississippi, we sprayed the trees with Paris green, 2 ounces of poison to 5 gallons of water. Some of the trees were sprayed but once, others twice, but the result was the same—no worms, and our trees were green while all around us the trees were stripped bare as before. This spring (the fifth season) in many yards it seemed as if every blade of grass was covered with the moths. By dint of watching we found fifteen only in our own yard, while by stirring up the people through the papers we have persuaded many to try the spraying, and those who have done so are happy in freedom from the pest, with green trees, while others are, as heretofore, bare of leaves and trees, walks, fences, and houses covered with the disgusting things. I am persuaded that in this way the trees may be saved.—[Mary F. McCluney, 214 East Sixth street, Sedalia, Mo., July 3, 1890.

London Purple for the Rose Chafer.

I have the honor to report that about the 15th of May last, the Rose Bug appeared and swarmed in my vineyard in countless thousands. They proved very destructive, feeding not only upon the foliage but also attacking the fruit clusters just then

* Rep. Commissioner Agriculture, 1887, p. 162. Indiana Farmer, November 27, 1886.

blooming on some varieties of grapes. Jarring the vines and catching and destroying the bugs made no perceptible diminution in numbers. I thought my entire crop of grapes was doomed. I concluded to spray the vines with London purple. On May 29 I sprayed a row of one hundred Massasoits, using at the rate of 1 pound of purple to 150 gallons of water. I sprayed with the Eureka Sprayer and awaited events. On the next day but few bugs could be found on the treated vines, and on the second day following they had entirely deserted the row. The foliage received no injury from the spraying.—[John K. Hoyt, Luther, N. C., July 21, 1890.]

Maple-tree Borers.

I should like to be informed by what name a borer which bores through the center (longitudinally) of the maple tree is designated and what means are adopted to destroy it. I have some young maple trees suffering from this pest. They first seem to girdle the trees with a series of holes not far from the ground, rendering them so weak that they are easily blown over in the wind, and then eat or bore upwards through the heart of the tree.—[Thomas R. Clark, "Riverside Park," New York, June 25, 1890.]

REPLY.—It will be impossible to certainly name the insect which has been attacking your young maple trees without seeing specimens, as there are a number of species which are known to work in general as described by you. It is more than probable that you have confused two of the common pests of the maple. The Lepidopterous Maple Borer (*Ageria aceris*) occurs very commonly throughout the country and is frequently a most serious pest. A full account of this insect is given in Riley's Sixth Missouri Report, pages 107 to 110. The larva girdles the trees but does not puncture the hard wood, confining its work to the sap wood.

Another maple borer frequently met with is the beetle generally known as the Flat-Headed Apple-Tree Borer (*Chrysobothris femorata*). The larva of this insect in young trees would be very apt to penetrate to the heart of the tree as you describe.

There are no entirely satisfactory remedies against either of these insects.

The Flat-headed Borer, which appears in May and June, as also does the moth of the *Ageria*, may be deterred from depositing its eggs on the trunks of trees by coating the trunks with a strong soap solution or with kerosene emulsion. The same treatment may be of value against the *Ageria*. Whitewashing the trunks of the trees has been recommended. It will be a good plan also to burn trees badly infested early in the spring before moths or beetles have issued.—[June 26, 1890.]

A Bot-fly infesting Hogs.

"Mr. S. S. Cook came up from his farm last evening and brought with him a specimen of a worm that is making trouble among his hogs. He has a drove of about fifty as fine hogs as there are in the county. Several days ago he noticed one of them wheezing badly, scarcely able to draw its breath, and thinking it had some obstruction in its wind-pipe, he determined to investigate. As he was sure the hog would die, he had it killed. In making an examination for the cause of the trouble, he found that several peculiar looking worms, about an inch in length and about a quarter of an inch in width, had eaten a hole from the outside of the neck clear through the windpipe, and were slowly but surely strangling the animal. He secured one of the worms, and has it with him. He says that several of his hogs are affected in the same way and he is afraid he will lose the whole lot."

Please find inclosed a worm and clipping from newspaper sent me by Mr. S. S. Cook, of Parkersburg, Wood County, W. Va. He respectfully requests that the subject be examined and a report made to him as to whether he should have the hogs killed or if there is any remedy which can be applied in the case. The drove consists of fifty head and are of a superior breed.—[D. R. Neal, jr., Bureau of Provisions and Clothing, Navy Department, Washington, D. C., July 28, 1890.]

REPLY.—The newspaper clipping and a specimen of an insect which is infecting your hogs has been received. This matter proves to be one of great interest, and so far as I know is the first case on record where hogs have been affected by Bot flies. Examination of the larva which you sent shows that it belongs to one of the internal bots which can only be determined specifically by rearing the adult fly. From the study of the characteristics of this larva it seems to belong to the genus *Cephenomyia*, the species of which ordinarily infest deer. Did you save any other specimens, and if so were you thoughtful enough to put them in alcohol? If so we should be very glad to receive additional material, and if any more of your hogs are taken with the same symptoms and you conduct a *post mortem*, please send us some of the worms *in situ* with a good piece of the wind-pipe and surrounding tissues.—[August 1, 1890, to Mr. S. S. Cook, Parkersburg, W. Va.]

A Peach-tree Leaf-beetle.

I send in a separate package some beetles found eating in a moderate degree the leaves of young peach trees from the pit this spring. They are not common and we wonder if they are liable to do any damage. Will you please tell us what they are and the prospects of their being injurious?—[Henry A. Brainard, San José, Cal., July 22, 1890.]

REPLY.—I beg to acknowledge the receipt of your letter of the 22d instant, together with the accompanying specimens of an insect which is eating the leaves of young peach trees. This insect is one of the leaf-beetles, and is known as *Chrysochus cobaltinus*. It has no common name. Like all of the other beetles of the same family it feeds upon the foliage of different plants, and any of them may at times increase so as to do some damage. This insect, however, is not known as a pest, and we should therefore like to be notified in case it increases to any great extent. It can always be kept in subjection by spraying the trees with a very dilute arsenical solution. It should be remembered that the peach is particularly susceptible to the action of arsenic, strong solution burning the leaves to a greater or less extent. For a trial application I would not advise the use of a larger proportion than one-half of a pound to 225 gallons of water.—[July 30, 1890.]

Mites in a Warm-house.

I send you the insects on the prunes in this glass; they are too small to catch and put in a vial. Hold the glass in the sunshine and you can see them move with the naked eye. They are very small. This is what I know about them: I built a warm-house three years ago on a brick wall 16 inches through, sided and ceiled with dressed pine lumber, and painted inside and out. The space between the ceiling and siding (16 inches) was filled with sawdust fresh from the saw and the floor was laid with brick. In three weeks after this house was completed the insect made its appearance and staid until cold weather, and each year in April it has come and staid until cold weather. The color of some of them is red. They seem to want to get about milk and things sweet, like jellies and prunes, and meal seems to be a favorite food for them. They got on the meal in a barrel in the warm-house by the millions, until the top seemed to be covered with dust, and we put the barrel, without cover, out in the sun, in August last, and they kept multiplying as we would skim the top of the meal off, taking the most of the bugs (or what) away, but they would be just as thick again in a day or two. They even crawl across the porch into the kitchen. Now, what I most want to know is will they be likely to bother in an underground cellar dug on the same spot as the warm-house? We burned sulphur and tobacco in this warm-house by the pound at a time, but it seemed to do no good, and we even washed it inside with diluted carbolic acid, but they were on hand again in a few days. I would like to know all about them, as the little pests have cost me about \$200 and lots of vexation. They seemed to come with the warm-house, and now that I have torn it out I don't want to build something else to harbor them.—[Albert Pound, Soonover, Ind., July 25, 1890, to F. M. Webster, La Fayette.]

REPLY.—Your letter of July 25, with the accompanying specimens of mites, has been forwarded to us by special agent F. M. Webster, for reply. The mites are probably the species known as *Tyroglyphus siro* L., a species which, together with an allied form *T. longior*, is frequently reported as infesting granaries and grocery supplies, such as cheese, flour, and meal. Your account of their occurrence in your warm-house is interesting, and it would seem that the measures you have taken to rid the place should have been successful. If the warm house could have been tightly closed, the fumes of burning sulphur maintained a sufficient time, ought to have been effective in destroying the mites. The use of bisulphide of carbon would have been attended with more satisfactory results. This substance will vaporize readily and is a powerful insecticide, but very inflammable, and on that account care should be taken in its use. Its disagreeable odor may be easily dispelled by thorough airing. Where benzine can be used it will also prove an efficient means of destroying these pests. I can not understand why the mites should have been so numerous and persistent in your case, unless they were repeatedly introduced with some of the material (meal, etc.) stored in the warm-house. I think that you will run no risk in constructing an underground cellar on the spot formerly occupied by the warm-house, if precautions are taken not to introduce mites with old meal or other material.—[August 5, 1890.]

A Beetle in Stramonium.

I found these evidences of the ravages of the beetle you kindly described for me at Mr. W. S. Thompson's drug store, 703 Fifteenth street, to-day. The stramonium had been in a tightly closed can too.—[A. H. Hoehling, Washington, D. C., May 6, 1890.]

REPLY.—The beetles which you sent from Mr. Thompson's drug store in stramonium proved upon examination to be *Sitodrepa panicea*, well known to affect all sorts of preserved drugs.—[July 5, 1890.]

The Pear-slug on Plum.

I send you a box per express containing cuts from plum trees that are being destroyed by an insect that is new to the foliage of this tree in this vicinity. I have never before seen them. The effect is the same that is often seen on my rose-bush foliage, but I think the enemy is not the same. The samples sent show the leaves after the insect has finished the tree; also the green leaves where they are now at work. I have not been able to determine the origin, but evidently they come from an egg laid. After the substance is all eaten from the leaf the insect is seen going to the ground. Further than that I have not been able to trace them or find their development. I hope to see a history of the enemy and its parentage and habits in your valuable publication, INSECT LIFE. An unusually cold, backward, and at times wet season has seemed to diminish the usual quantity of most varieties of vegetable enemies, except the cut-worm and white grub, which are rather more plenty than usual. Twice spraying with Paris green has saved a fine crop of growing plums on all the trees where fruit set after full blossom, but some trees with profusion of blossoms show no fruit at all. At full growth the worm is one-fourth of an inch long, and under a glass looks like jelly, smooth and glossy, generally a dark stripe along the back. I hope some may be alive, that you may see them under a more powerful glass than I have.—[W. S. Wood, Shawano, Wis., June 23, 1890.]

REPLY.—Your favor of the 23d inst. was duly received, accompanied with specimens. You are right in believing that the larva on the plum is distinct from the rose-slug. It is, however, closely allied to the rose-slug, and belongs with very little doubt to the pear-tree slug (*Eriocampa (Selandria) cerasi*), the larva of which is known to feed on pear, quince and plum. The eggs are deposited by the parent saw-fly early in June in little slits in the skin of the leaf. The young larvæ soon

hatch and feed on the softer parts of the leaf, skeletonizing it. Full growth is reached in June and the larva crawls or falls to the ground and buries itself in the earth. The flies appear in July and deposit eggs for a second brood. The larvæ of this brood enter the ground about the last of August and do not transform until the spring following. They may be easily destroyed by spraying with hellebore, which may be mixed with water in the proportion of one ounce to two gallons of water, or by spraying with the arsenicals, London purple and Paris green. These may be used in the proportion of 1 pound of the poison to 100 or 125 gallons of water.—[June 27, 1890.]

The Black-locust Hispa.

I inclose some locust leaves (which are stung or eaten by a worm or insect) for the purpose of ascertaining if possible what it is that is doing the mischief, and if a remedy can be suggested to prevent it. Nearly all the locust timber has been affected in this manner in this section for about three years past. If it continues one or two years more it will doubtless destroy all that kind of timber in this part of the country. It seems to blight nearly all the leaves on each tree. [Henry Haymond, Clarksburgh, W. Va., August 4, 1890.]

REPLY.—Your favor of August 4, together with inclosed specimens, was duly received. The specimens in question are the common locust Hispa (*Hispa dorsalis*), a very widely distributed beetle and one that frequently occurs in injurious numbers. The injury is chiefly occasioned by the small, flattened larva which mines the locust leaves. The beetle, which is of a tawny orange color, marked with black, and about a quarter of an inch long, also feeds on leaves of the locust. The beetles that are now appearing will hibernate through winter, and will deposit their eggs on the locust leaves as soon as they are expanded the following spring. The fact that the larvæ are leaf-miners makes it difficult, if not impossible, to reach them with any of the ordinary insecticides. The beetles, however, may be destroyed by spraying with Paris green or London purple, and these poisons may best be applied in spring as soon as the leaves are expanded. The adult beetles feeding on the leaves will be destroyed before they have deposited their eggs. This treatment is impracticable over extensive forests.—[August 7, 1890.]

Importation of Hessian Fly Parasites.

I mail you to-day a tin box containing about three hundred *Semiotellus nigripes* (the actual numbers are 114 ♂ and 173 ♀) some of them bred since last Thursday—seven days old—but the greater part bred since Sunday last. I hope many of them will arrive alive and kicking and in laying condition. I sent one dozen and a half last week. Next year I will try and send a package of screenings, for I think this would be the surest way of introducing these parasites. So far my experimenting has been successful, for out of 10,000 Puparia I have bred but a single pair of Hessian Flies and about 700 parasites, which I am distributing in certain districts. Many of the *Semiotelli* have been bred from screenings, and I am inclined to think there are two species.—[Fred. Enock, 11 Parolles Road, Upper Holloway, London E., England, June 11, 1890.]

REPLY.—Your letter of the 11th instant, with accompanying specimens of *Semiotellus nigripes*, came duly to hand. Unfortunately the insects were, without exception, all dead, as were also a former lot received from you a few days since. I trust that better luck will attend the sending of screenings which you promise for next year. I shall be very glad if this parasite can be successfully introduced here.—[June 20, 1890.]

Insects determined.

You will find inclosed a few specimens of insects, which I would be glad to have you identify through the columns of INSECT LIFE. They were all taken from a wheat

field, except the moth, which is quite commonly met this spring. No. 3 and the larva 5 were observed to feed upon the Grain Aphid; the others were found in considerable numbers on the heads of wheat, except No. 4.—[C. C. Fenwick, St. Joseph, Ill., June 23, 1890.]

REPLY.—I beg to acknowledge the receipt of yours of June 23 with accompanying specimens. No. 1 is *Melanectes puncticollis*, family *Elateridae*; its larval habits are unknown and it is a tolerably rare beetle. No. 2 is *Anomala undulata* and belongs to the family *Scarabaeidae*. This beetle is not infrequently injurious to wheat and other grains. No. 3 is *Coccinella 9-notata*, family *Coccinellidae*, one of the common Ladybirds. No. 4 is *Tetraopes tetraophthalmus*, family *Cerambycidae*. This borer lives on milkweed. No. 5 is the larva of No. 3. The moth sent is *Platysamia cecropia*.—[June 27, 1890.]

Cheese Mite.

I have inclosed a fungus found on cheese for the first time, as it is something new. Is there any preventive?—[Frank H. Follensbie, Enfield, N. H., June 13, 1890.]

REPLY.—Your favor of the 13th instant, with the accompanying specimens, has been received. The supposed fungus found on cheese is the common Cheese Mite (*Tyroglyphus siro*). The brown, powdery mass is composed of the particles of cheese and the shed skins of the mites. If you examine this material with a hand lens you will find the minute whitish mites scattered through it. This mite lives on all kinds of cheese, especially if it is a little decayed, and particularly on the rind or harder parts. It also infests flour, grain, and other substances. In your case the only preventive would seem to be to keep the shelves thoroughly cleaned of all particles of cheese and to destroy or remove the stale cheese.—[June 19, 1890.]

Fighting the Rose Chafer.

Reading in April number of *INSECT LIFE* on *Macroductylus subspinosus*, I would say that at present I have an attack of them in my vineyard, that I have tried pyrethrum, 4 ounces to five gallons of water, applied with a Eureka sprayer, and found it of no use. The solution, or mixture, seems to affect them so that they fall off on the ground and after a time fly away. Later I used 2 ounces of hellebore and 4 of pyrethrum, and sprayed it, but find that also of no avail, so I have tried shaking on stretchers saturated in petroleum, and I destroy hundreds that way. Therefore, I am able to say that pyrethrum in my case was useless. Do you think a spraying of carbolic acid would be of any use in driving them off? I would also state that I have picked hundreds and crushed them in my hand, and consequently I do not believe the poisonous theory, unless there be an abrasion of the skin or a sore.—[E. H. Wynkoop, Catskill, N. Y., June 19, 1890.]

REPLY.—Your letter of June 19 duly received. Your experience with the *Macroductylus subspinosus* is certainly in harmony with the article to which you refer in *INSECT LIFE*, and you will see that I have stated that hellebore and pyrethrum are of doubtful efficacy, the former being the most effective against the beetles. I am glad to learn of your success with the use of stretchers saturated with kerosene, and I believe that this is the most practical of the remedies yet proposed. General Pearson, who is quoted in the article referred to as recommending *eau celeste* as a means against the Rose Beetle, now reports that the present year he finds this remedy unavailable.—[June 3, 1890.]

SECOND LETTER.—Yours of the 23d instant at hand. Would say that I find a stretcher saturated with crude petroleum quite effective, and after saturating a few times the bugs stick to it so that it does not require any shaking in 'o a receptacle. I received to-day a trial package of Nicotina from the Farmers' Fertilizing Company, Syracuse, N. Y., but as the bugs have left my vineyard, I can not indorse it. I think it must prove effective, for it so strongly smells of gas-tar, and is in a very fine powder, and I find anything that has a strong odor distasteful to them. In fact one

man told me he had driven them from his vineyard by burning pieces of old rubber between the rows. The manufacturers are responsible and claim Nicotina to be the best insecticide in the world. The sample 5 pounds was sent me to try and report.—[E. H. Wynkoop, Catskill, N. Y., June 27, 1890.]

ANOTHER LETTER.—I received a line from you last year to try the Bordeaux Mixture. We have had no rot or mildew, but have something just as bad, that is, the Rose Bugs. They have stripped a good many large vineyards this year. I have been spraying about 18 acres out of 20 with good results. I used lime-water as strong as I could use in the spray pump, about 1 bushel of unslaked stone lime to 50 gallons of water and 1 pint of crude carbolic acid. Two acres that I did not treat gave an entire loss of fruit. Our apples, pears, and peaches are an entire failure this year on account of late frosts. The clay lands south of us were troubled with the black rot last year; the Rose bugs are confined mostly to the ridge land. I have tried London purple and Paris green and Hellebore without any effect on them. Some have used the dry lime, but the solution is far better. Will give you the results at the close of the season if you desire it. I have made a specialty of fruit for forty-six years. The lime does not kill the Rose bug, only prevents it from eating. If there is anything that will kill them let us know before another year. I tried the same formula on one-half of my cherry-trees, saved a good crop, while the half not treated did not have a cherry left—a good test.—[S. Justus, Mentor, Lake County, Ohio, June 22, 1890, to B. T. Galloway.]

REPLY.—Your letter of June 22, with specimens, duly received and referred to this Division by Mr. Galloway. This insect has been fully discussed in a recent number of *INSECT LIFE*, a copy of which has been sent to you. The lime-water treatment which you report as being very satisfactory, is one of the more efficient of the remedies against this insect. Other remedies of even greater value are mentioned in the article referred to, but they are all of little avail against an exceptional onslaught. We shall be pleased to receive the report of the results of any other experiments you may make.—[June 25, 1890.]

Wire-worm Damage to Onions.

I send by to-day's mail a small box containing some worms that are doing a great amount of damage to the onion crop in this part of Washington (w st). I found a number of the onions turning yellow and found the worms working on the plants below the surface, from one to four worms at each infested plant. If you could give us the name and tell us the best way of destroying them you would be doing us a great kindness.—[Nicholas Vipond, Minter, Pierce County, Wash., June 18, 1890.]

REPLY.—I beg to acknowledge the receipt of yours of June 18, together with the accompanying larvæ found infesting onions. The larvæ belong to the click or spring beetles, the particular species of which can not be determined from the larvæ, as the latter are scarcely distinct in allied forms. The larvæ sent, however, may be referred to the genera *Drasterius* and *Agriotes*. The larvæ of the family Elateridæ, which includes the genera mentioned, are the well known wire-worms, which are known to injure a large number of cultivated crops. The beetles, however, may be trapped successfully before they have deposited their eggs in the spring by means of poisoned bait. Professor Comstock, of the Cornell experiment station, has obtained excellent results by using the same remedy which I found so effectual for cut-worms, i. e., by taking bunches of clover dipped in a moderately strong solution of Paris green or London purple and placed at different parts of the infested fields. These baits should be renewed once or twice a week during the early part of the summer, or the period during which the eggs are deposited.—[June 25, 1890.]

Orange-tree Bark-borers.

Since the freeze last winter which killed so many of our orange trees a great many bugs are boring into them, mostly into the dead wood, but some into the sound wood.

I send you a piece of the wood with some of the bugs in it and some of them in a quill. I have found them three-quarters of an inch deep in the wood. I would like to know if they will kill the trees.—[B. Foster, Daytona, Fla., June 16, 1890.]

REPLY.—The beetle which accompanied your letter and which you found boring in orange trees is one of the family of Bark-boring Beetles, *Scolytidae*, which includes a number of our most injurious insects. The species in question is *Xyleborus pubescens* and breeds in oak and other semi-tropical trees. The mature beetles burrow in trees of all sorts but have never been known to infest healthy living orange trees, but when found in the orange always occurs in the dead or diseased wood. It can not, therefore, be considered injurious to the orange. The freeze of last winter, which you say killed many of the orange trees, accounts for the presence of numbers of this insect.—[June 20, 1890.]

Rhizococcus on grass.

I send you by mail this day some Coccids. I found them yesterday in the same field referred to in INSECT LIFE, Vol. II, No. 10, April, 1890, page 326. This is the first time I have seen them since about February 1. They are on the same field and about the same numbers. They have not been observed in any other place. I fail to see that they have affected the grass in any way.—[James Powers, Lexington, Ind., June 16, 1890.]

REPLY.—I have just received your letter of June 16, together with the accompanying specimens of *Rhizococcus* on grass. I am glad to get additional information on this interesting Coccid and will file it for future use.—[June 18, 1890.]

The Grape Curculio.

Is there anything that will destroy that most abominable pest, the Grape Curculio (*Caliodes inaequalis*), which is on my grounds in countless numbers, doing more harm than all else combined?—[G. R. Wood, Lyndon, Ky., July 23, 1890.]

REPLY.—Your letter of the 23d, regarding the damage done in your vineyards by the Grape Curculio, has been received. I fear very much that I can not help you in this matter. I published a short account of this insect in my first Missouri report, and Mr. B. D. Walsh is the author of a more elaborate account in his first report as acting State entomologist of Illinois, published in the Transactions of the Illinois Horticultural Society for 1867. No suggestions of any great value have ever been made. Mr. Walsh thought that at the time the eggs were being deposited, say about the middle of June, some good could be done by shaking the beetles from the vines upon sheets, as is done in the case of the Plum Curculio. If it can be ascertained by observation just when the beetle begins to be abundant upon the vines, a spraying with a kerosene emulsion will doubtless destroy many of them. In order to make these of any avail, you will have to familiarize yourself with the appearance of the beetle, if you do not know it already. It would be interesting to make some observations on the feeding habits of the beetles early in the season, as it may be that they feed upon the grape leaves or stems, in which case we should have a ready remedy in the application of an arsenical mixture, as in the case of the Plum Curculio. Does this insect appear in numbers upon your grounds every year and is it very common in your neighborhood? I have rarely heard of it of late years, or I should otherwise have made further observations in the lines which I have just suggested.—[July 26, 1890.]

Scale-insects in California.

I send with the same post as this a small scale found in an orchard here two weeks ago. I sent specimens to Professor Coquillett, but he could not name it. The tree it is on is commonly called the box-elder. It seems to me to be a species of *Acer*. I

have not been able to find any eggs under any of the scales, nor have I seen any of the young. The scale seems a species of *Lecanium*, and I have only found it on the one tree. I will keep a close watch on it and observe future developments. We are busy inspecting the orchards here for *Lecanium oleæ* and *Lecanium hesperidium*. One or two patches of *Aspidiotus aurantii* have made their appearance here, but these were quickly cut out and burned and the infested trees and those surrounding them sprayed with a strong caustic-soda solution. I have been only a few months at the work of inspection, but it is interesting me greatly. I have been for many years a diligent natural-history student in Scotland, so possess an advantage of long training to observe over the other inspectors here. I find great difference of opinion existing regarding the black and brown scales, some maintaining that they will do the tree and fruit no harm, others that they will in the end kill the tree. Some say that they will not increase, but will die out in this hot and dry climate; others say that they will soon be over all our orchards. Then, the same difference of opinion exists about the effects of the various solutions for spraying and the time they should be used. Several instances of injury done, both to the fruit and trees, have occurred by spraying according to the orders of the commissioners; so that some other remedy is being sought after by the orchardists. So much difference of opinion is confusing to a novice, but I have set about trying to find out for myself.

In the district assigned to me I go over each orchard carefully, noting the percentage of trees infected with either scale, so that by next year I will be able to say whether it increases. I have tried the effect of some of the washes on the young of the black scale, and find a potash wash the most effective in killing them. The alkali in the solutions seems to me to be the active agent in killing. We recommend in the mean time a solution composed of 1 pound pearlash and 2 pounds resin to 1 gallon of water; then one part of the mixture to from six to eighteen parts of water, according to the strength required. In some cases the resin sticks on the fruit. I intend trying oil instead of the resin to see how it will do. Black scale is very generally distributed over our apricot and orange orchards, but not in large quantity. I found the eggs under the scales beginning to hatch in June. They are continuing the hatching process yet. Though the great majority of them are hatched, only in very few cases have I found young scales forming on the stems or leaves. In many cases I find both the young and eggs killed under the scale seemingly with the dryness or heat. The killing of the scale was more apparent in an instance where the trees had been trimmed up. In one case I found what seemed a parasite inside of a scale. It was three times the length of the young scale, had wings appressed to its body evidently in an immature state and scarcely so long as its body, jointed antennæ one-third the length of its body, a small head, and prominent eyes. I recently examined three orchards that had been sprayed for black scale, two of them with a caustic soda solution consisting of 8 pounds of caustic soda, 25 pounds of resin, 2 gallons of oil, and 200 gallons of water. I found about 5 per cent. of the scale still alive on the trees three weeks after the spraying had been done; the trees were partially defoliated and a small percentage of the fruit defaced by the action of drops of the solution in the two orchards sprayed with the soda. In the one done with the pearlash solution I found about the same percentage of the scale alive, no leaves having fallen from the trees and the fruit being quite uninjured. I made some experiments with kerosene emulsion, but was convinced that the kerosene had little effect on the scales. Young scales lived for half an hour in pure kerosene. They died almost instantly in a weak potash solution. Another disputed point among the orchardists here is the influence of ants on brown scale; many say they eat the scale. I have never seen an instance of an ant tearing off a scale from a leaf or twig, but when the scale is torn off by some other means they greedily carry away whatever is under it. Some orchardists assert that the ants nurse the scale for the food it affords them. Another difficulty is when to spray an orchard. Some have sprayed them now, and intend spraying again in October, but the general opinion is that the heat will accomplish what the spraying will do at this season and that all that is necessary is to spray in

October. The extent and rapid increase of our orange orchards make it of the utmost importance that a sure means of keeping them clean and free from all injurious insects is discovered and applied. There is an effort being made just now to get a gasing apparatus to apply the hydrocyanic gas to scale-infested orchards. We are comparatively free from pests in the mean time, but there are a few, and the fear that they may spread is directing attention to increased efforts to get rid of them. The scare from Florida scale has led to increased vigilance and closer observation. I found a few live purple scale on young Florida trees newly planted out this spring and made it known, calling attention to the danger. But no live Florida scale have been found on trees planted for one or two years. A few live wax scale were shown me from young Florida trees that were imported this season, but with these exceptions, as far as I have heard, the Florida scale now found is dead. My time for research and investigation is rather limited. Inspectors are not paid for such work, and it must be done after the usual working hours. I think sometimes money could be profitably spent in paying for observation. Another difficulty I have is in mounting specimens for the microscope. I have not been able to find a suitable material for preserving the specimens on the slides, but perseverance will in the end insure success. San José scale (*Aspidiotus perniciosus*) is abundant on all our deciduous trees except apricots, and a few were found on them this season, but it is not getting so much attention, as the deciduous trees are no source of income here, so they are being generally rooted out to make room for orange trees. I have seen many deciduous trees nearly killed with this scale. While getting specimens to send I found plenty of young settled on the leaves.—[D. Gregorson, Riverside, San Bernardino County, Cal., July 30, 1890.]

REPLY.—I beg to acknowledge the receipt of yours of the 30th ultimo, together with the accompanying specimens. The scale insect which you find on the box-elder (*Negundo aceroides*) is a new specimen of *Lecanium*, which we have had from California on many occasions, but on a variety of plants. Your letter is very interesting, and I shall take the liberty of publishing portions of it in INSECT LIFE. The black scale has in some portions of California a moderately effective parasite known as *Dilophogaster californica*, which may account for its not spreading with you. The orchardists who contend that ants nurse the scale insects are undoubtedly correct. Your experience with kerosene emulsion is exceptional, and probably ill-founded.—[August 6, 1890.]

Household Pests.

I am in receipt of your favor of the 17th instant; also of INSECT LIFE. I find these periodical bulletins quite interesting, and am much obliged to you for them. Perhaps the reason the bug did not reach you was that it was put in a glass vial, and the vial was packed in a sardine box, the glass being interdicted. I am sorry you did not receive it. Reading on page 211 of INSECT LIFE I find your article "The true clothes moth," and I am surprised to find that you and I differ on this point, and while I don't boast of any science or learning on the subject, I feel like defending my opinion, for I have a life-long experience at my back, and my business—an old merchant—required me to be on the alert for this little household pest. In the old times, away back here in the mountains, where the merchant kept everything and when store clothes were the exception, the apartment was not complete without a piece of satin and a few yards of broadcloth on the shelves—old English-made cloth, just the thing to get damaged—\$6 to \$7 per yard. We used to be shocked occasionally by finding that the moths had cut dozens of holes in the best pieces of goods we had. Then search had to be made, and it resulted in finding a diminutive hair-worm very much after the order and style of that larger cousin of his, the terror of the furrier and the dealer in peltries—the ordinary hair-worm. But this little fellow differs in shape from that cousin of his, as well as in size, for he tapers more rapidly from the head to the tail, and to that appendage has an arrangement of hairs upon it giving it a forked appearance. (See specimens, which I send you by this mail, of this true

moth.) The history of these specimens is curious, and I will give it to you. They were found a year ago in a parcel of ground black pepper which I had left over in my old store—adulterated pepper, which being found to be worthless, was shoved aside years before, and I put them away in the trash—the pepper and the paper in which it was packed, intending to send them to you. To-day to my surprise I found surviving—the progeny of course—several of them, and I fixed them up for the mail. I also found specimens of the book moth, a slick, lively fellow, associating with them, and I packed them all up together. He riddles the edges of well-sized paper stowed away in trunks, boxes, etc., where not often handled. In the trash I found still another household pest—a flour worm—attracted to the pile by the meal it contained, meal put in to make the paper weigh, and I just leave him “to fill.” And now I am puzzled to know what all these moths were doing in this pepper, for there were hundreds of them, continuing in the haunt for years. Hoping my contribution may reach you safely and prove interesting.—[Calvin J. Cowles, Wilkesboro, N. C., June 20, 1890.]

REPLY.—I beg to acknowledge the receipt of yours of June 20, together with the accompanying specimens. You do not make it very clear in what particular your experience does not agree with the facts given in the article in *INSECT LIFE* on the “True Clothes Moths.” The larva which you style the “Hair Worm” is the larva of *Attagenus megatoma*, one of the Dermestids and somewhat closely allied to the common form which infests furs, and dried specimens of animals, insects, etc. This insect is not a moth at all, but a beetle. The true clothes moths described in the article referred to by you are so called to distinguish them from the Carpet Beetle or popularly styled Buffalo Moth (*Anthrenus scrophulariæ*), which is also a near ally of *A. megatoma*. The Fish Moth, or “slick, lively fellow” of your letter, is with little doubt a *Lepisma*, although none of them were found in the package. The Flour Worm, also found in the package, is the larva of *Tenebrio obscurus*. The Fish Moth and *Tenebrio* larva would find in the mixed pepper and flour a suitable food, especially if the pepper was without strength. The Dermestid may have been attracted by the dead insects or other animal matter in the adulterated pepper.—[June 26, 1890.]

The Rose Chafer on Clay Lands.

Your favor of the 27th ultimo was duly received. No one of whom I have asked the question in this section has ever known of the Rose Beetle attacking vegetation on clay lands. In fact some of our local savants have recommended placing clay around the roots of our grape-vines, etc., as a protection from the beetle. I have never heard of its being done, and of course can not answer as to efficacy. I have inserted in our county paper of this week a request to the people living on clay lands in this county to let me know if they have ever known of the beetle committing ravages on their lands and I will send you a copy of the paper marked. I am no entomologist, but am interested in anything of the kind.—[J. S. Strayer, Port Republic, Va., July 2, 1890.]

REPLY.—The question as to whether vegetation growing in clay soil is exempt from the ravages of the Rose Chafer is entirely one of proximity to the breeding places of the insect. It is often stated that this pest is most abundant upon crops growing in a light or sandy soil, but this simply proves (and my experience as given at the bottom of page 296 confirms it) that the beetles breed in such soil and not in stiff clay land. Naturally on issuing from the ground as beetles they attack the nearest appropriate food. Crops growing on clay land, then, are exempt or partially exempt simply for the reason that the insect does not breed in such soil. Given a case when a clay soil immediately adjoins a light soil, you will find that the beetles will freely attack the crops growing in the former soil, *provided there is not sufficient food immediately at hand* and growing in the sandy soil or loam. The idea of your “local savants” that placing clay around the roots of the grape-vines will prove a protection from the beetles is, in this view of the case, entirely erroneous.—[July 8, 1890.]

Tomato Worm.

For four years the tomato vines in my garden have been nearly ruined by a long green worm about the size of a cigar cut in half. This insect has a most voracious appetite and lives on the leaves of the vine, and makes its appearance some time in July when the fruit is young. When and how does this worm originate? And above all, is there no solution, ablation, or deglutition that can destroy this pest? If so, please send me the way and means.—[Alexander Hunter, Washington, D. C., June 13, 1890.]

REPLY.—Yours of the 15th instant has been received. The insect which you describe as injuring your tomatoes is the common Tomato Worm (*Sphinx quinque-maculata*). If it should become abundant before the tomatoes have attained any size it will be perfectly safe and effective to spray the vines with London purple or Paris green in the proportions of one-quarter of a pound to 100 gallons of water. If, however, it does not put in appearance until after the tomatoes have attained some size it will hardly be safe to apply these poisons. Ordinarily hand-picking is the best method. The large size of the worms and the marked defoliation of the vines render it easy to detect them. The winter is passed in the chrysalis state in the earth, and if care is taken during the spring plowing to collect and destroy all the chrysalids turned up, the numbers of larvæ will be greatly reduced for the coming summer.—[June 17, 1890.]

The Pear-slug on Quince.

I send you some specimens of some kind of a "varmint" that I noticed for the first time last summer on my Quince bushes, but I destroyed them all with insect powder and Paris green before I thought of sending you a specimen. To-day I was trimming my pear tree and discovered some of the same kind of slugs, so after consulting neighbor Kellogg I thought best to send you a collection and ask if it is anything that may do much harm if let alone to propagate and multiply and replenish the foliage of the Quince and Pear trees. Where do they come from and where do they go to, and have they a father and mother, or are they natural-born orphans? They don't look to be very ferocious; but you see how they eat the pulp or soft parts out of the leaves. Neighbor Kellogg and I examined the things with a magnifying glass and could not discover any legs, horns, hair, teeth, toe-nails, tail, ears, or topknot, but came to the conclusion that you would know all about them as soon as you saw them, and would tell us something about them, and whether it would be best to spray them with Paris green. I send specimens from the Pear and Quince; they all look alike to me. As the INSECT LIFE comes to me regularly, I will look in it for what you may be pleased to say about my big catch.—[L. W. Ewing, Oneida, Ill., June 24, 1890.]

REPLY.—I beg to acknowledge the receipt of your letter of June 24, together with accompanying specimens. The specimens sent prove to be the larvæ of the Pear Tree Slug (*Eriocampa* [*Selandria*] *cerasi*), one of the Saw-flies (*Tenthredinidæ*). They are frequently abundant on the Pear and also known to attack Quince. The larva descends to the earth to transform, hibernating in a little cavity and producing the next summer a black four-winged fly. They may be destroyed by the use of hellebore or slaked lime, or either of the arsenicals, Paris green or London purple. It would be advisable to spray your trees early as there is danger of their becoming sufficiently numerous to do much harm.—[June 27, 1890.]

GENERAL NOTES.

DESTRUCTIVE LOCUSTS IN MESOPOTAMIA.

Mr. Constantine C. Metaxas, delegate to the French Société Nationale d'Acclimation at Bagdad, publishes* an account of injurious grasshoppers in the district of Irak-Arabi, of the province of Mesopotamia, in Turkish Asia. Since the year 1884 this region has suffered terribly from the ravages of two species of locusts, but it seems that a period of immunity began last year. One of the species is the well-known Migratory Locust of the Old World, *Acridium peregrinum*, the other, not named, is a non-migratory species of the same family. The former hatches in Mesopotamia usually toward the middle of March, becomes winged within a month, and disappears under the influence of the torrid heat towards the middle of June. All efforts to combat this species were, up to 1889, frustrated to a great extent by the invasion of fresh swarms in April. These always come from the southeast, and would appear to originate in southern Persia, or in Beloochistan, or still farther east. The non-migratory species hatches later than the *Acridium peregrinum*, and becomes destructive at the time when this species disappears.

Since the Cypriote locust machine† does not seem to be adapted to the conditions of the country, the Turkish Government ordered a wholesale destruction of the egg-capsules. Every inhabitant of the cities was required to deliver each winter 25 kilograms of egg-capsules, and for every plow in the country a similar tax of 50 kilograms was imposed. As a consequence a lively trade in locust egg-capsules sprang up each winter. The poor people industriously collected the capsules and sold them to the richer classes at 1 or 2 centimes (one-fifth to two-fifths of a cent) per kilogram. An ingenious tribe of nomadic Arabs even went so far as to manufacture and sell artificial egg-capsules.

Mr. Metaxas thinks that this measure, which was continued year after year, had a great deal to do with the cessation of the locust plague, but upon reading his account it appears to us that natural causes were much more potent in the desired result. The early part of the winter of 1888-'89 was an unusually mild one. The eggs hatched in January and the young locusts were killed by frosts in February. Since the same conditions seem to have prevailed farther east, there were no fresh invading swarms in 1889. The soil throughout Mesopotamia contains a great deal of sulphate of lime, and the locust egg-capsules consequently acquire a greater hardness and consistency than elsewhere. Spring rains are absolutely necessary to enable the young locusts to break through the operculum of the capsule. The year 1889 was an extremely dry one, no rain falling after January. and thus the

* Revue des Sciences Naturelles Appliquées, 37, No. 12, June, 1890, pp. 584-590.

† Mentioned by us on p. 60, Vol. II.

eggs failed to hatch, except in irrigated districts. Also, in consequence of the great drought and the drying up of all swamps, the birds, especially the "mouettes" congregated in enormous swarms on the irrigated fields and speedily destroyed the young locusts.

PHOSPHORESCENT CENTIPEDES.

That there are luminous Myriopods has been known for many years, as also the fact that they occur only among the family *Geophilidæ* of the Chilopod Myriopoda. Both sexes are luminous, sometimes quite intensely so, and the luminosity spreads out over the whole ventral surface of the animal. If one of these Geophilids is taken up the luminous matter communicates to the hand of the observer or to anything else with which the specimen comes into contact.

There is considerable dispute regarding the origin of this phosphorescent matter. According to Dr. R. Dubois it is contained in the epithelial cell of the digestive tube and the emission of the light depends on the moulting of the digestive tube. Mr. Macé, on the contrary, contends that the luminous matter is a glandular excretion, and that these glands (*glandes préanales*) are situated on the last two segments of the animal. Mr. J. Gazagnaire has satisfied himself that the luminous matter is secreted from glands situated on the sternal and episternal plates. Upon pressure these glands secrete a yellowish, viscous substance, having a peculiar odor and which is highly phosphorescent.

In a more recent article (Mém. de la Soc. Zoöl. de France, v. iii, 1890, pp. 136-146) Mr. Gazagnaire reviews all previous observations on luminous Geophilids, and finds that, so far as the European fauna is concerned, luminous specimens were found only between the end of September and beginning of November. The luminosity appears, therefore, only at a certain epoch in the life history of these Myriopods. Further, in all more carefully recorded cases, luminous specimens were never found singly, but always in pairs or in companies of three or more specimens. The few and fragmentary observations that have hitherto been made on the mode of reproduction in these animals seem to prove that the fecundation of the female takes place in autumn, or just at the time when the luminous specimens are found, and Mr. Gazagnaire is thus fully justified in connecting the appearance of luminosity with the excitement caused by sexual instinct.

In Algiers, Mr. Gazagnaire observed luminous specimens of *Orya barbarica* in the month of April, and he concludes that in other countries and in consequence of altered climatic conditions the period of luminosity probably differs from that observed in Europe.

FURTHER OBSERVATIONS ON THE PARASITISM OF DATANA ANGUSII.

Apropos to Mr. D. B. Wier's* criticism of a previous note of mine upon this subject, I may state that while I did not observe caterpillars being driven off the tree by Tachina flies, and was very careful not to say so, nevertheless, I did think such was the case.

The present season these larvæ have occurred in greater numbers than before for many years. The walnut tree, mentioned in my former note, has been again denuded of its foliage, not a leaf being left on its twigs or branches. The most critical search has failed to reveal a single Tachinid about this tree, nor did an examination of several hundred of the larvæ develop a single individual, with the eggs on its body. Another enemy to the pests entered the field, and, so far as could be observed, held undisputed sway. This was an Ichneumon, *Anomalon relictum*, and they were present in considerable numbers. The oviposition of these last parasites was frequently witnessed, but the parasitized host was seldom knocked or driven from the tree thereby. The favorite method of attack appeared to partake of the nature of still hunting, and, while isolated individuals were not ignored, particular attention seemed to be paid to those caterpillars which were bunched together on the trunk, in the act of moulting. From one to five of the Anomalous were observed about these masses of helpless larvæ, each walking about in search of a favorable opportunity to place her egg in the body of the host. If the eggs had been placed at random, those on the outer side of the mass would have received them to the protection of those whose bodies were nearer the center of the mass. Therefore, the parasites seemed to be on the watch for fresh hosts for their young, and would edge up to the mass, as new forms were exposed, and by throwing the abdomen beneath the thorax between the legs, they would with the rapidity of lightning thrust the ovipositor into the body of their victim, apparently without regard to locality. They did not appear to possess any great amount of courage, for when a larva made any movement, they quickly withdrew to a place of greater safety.—F. M. WEBSTER.

BIRD ENEMIES OF THE COLORADO POTATO-BEETLE.

In the report of the Ornithologist, Annual Report of the Department of Agriculture for 1889, page 369, Dr. Merriam gives the following note:

Further attention has been given to the bird enemies of the potato-bug, or Colorado Beetle, and a few species beside the Rose-breasted Grosbeak have been found to eat the pest occasionally. Among these is the Yellow-billed Cuckoo, already known as a valuable friend of the farmer because of its habit of feeding upon caterpillars, both smooth and hairy. With the Grosbeak the habit of eating potato-bugs proves to be fairly constant, but unfortunately the bird does not seem to be very abundant anywhere, and hence the resulting benefits have not been generally noticed. Some of our correspondents have suggested that the scarcity of this bird, and perhaps of

* INSECT LIFE, Vol. 3, p. 26.

others, may be due to the habit of eating insects in places where Paris green has been used, but after careful inquiry we find no warrant for believing such to be the case. We have not been able to learn of a single instance in which any undomesticated bird has been found dead in the vicinity of potato fields under circumstances pointing to this cause. Birds certainly exercise much judgment in selecting their food, and it is not probable that they would eat sickly or dying insects so long as healthy ones were to be found.

In our studies upon the Colorado Potato-beetle many years ago we mentioned the Rose-breasted Grosbeak, which was extremely abundant in various localities in the west in 1872, and we are pleased to notice that in Dr. Merriam's opinion the apparent diminution in the number of this beautiful bird is not due to feeding upon *Doryphoras* which had been poisoned by Paris green. We also mentioned the Crow and the common Quail as feeders upon the beetle, and are glad to note the Yellow-billed Cuckoo as a new enemy to it.

PROF. L. H. BAILEY'S SPRAYING DEVICE.

Prof. L. H. Bailey, in Bulletin No. 18 of the Agricultural Experiment Station of Cornell University, has recommended the adoption of "a spraying nozzle which is no nozzle at all." It consists simply of a device for pinching the mouth of the hose. A string pulls a lever which presses an arm against the end of the tube, flattening it against a stationary bit of metal opposite. The device is not patented, and it is expected that in the form of a little brass attachment it will be offered for sale by seedsmen. This arrangement will answer for certain kinds of spraying, but it will hardly answer for the application of certain insecticides where experiment has shown that the finer the spray the more satisfactory is the result.

SILK-WORM DISEASE IN CHINA.

The total silk crop in China last year was 25 to 30 per cent. larger than the previous one, a fact which warrants the belief that the silk-worm disease in North China is not spreading, and that there is no necessity for adopting the measures for its extirpation which were in contemplation last. That the disease exists has, however, been abundantly proved; but, according to the last consular report from Shanghai, experiments have shown that the Chinese silk-worms are constitutionally much stronger than their European congeners, and that even when the worms are diseased eggs may be produced, when under like circumstances it would be almost impossible to obtain them from European silk-worms. It is feared by experts that in districts where silk-worm disease spreads silk will in time cease to be produced. Meanwhile those who urge the necessity of preventive measures such as have been taken in Japan state that the quality of Chinese silk is deteriorating and that of Japanese is improving. In addition to the advisability of extirpating disease by selecting the best silk-worms and securing the sur-

vival of the fittest, improvements in the method of reeling silk have been strongly recommended, but hitherto little or nothing has been done by the Chinese Government to introduce these improvements, which would not only benefit the people, but augment the revenue. The foreigners who have established filatures at Shanghai are conferring a benefit on the country generally, and it is believed that good Chinese silk properly reeled in these filatures is the best in the world.—*Bell's Messenger* [London, England], August 25, 1890.

FUMIGATING FOR SCALE-INSECTS.

The process of fumigation for the Red Scale in California seems to be growing in popularity. We quote the following from the proceedings of the Orange County Board of Horticulture at its meeting of July 30, from the correspondence of the *Pacific Rural Press*:

Mr. Preble, of the Tustin district, reported that the work of Red Scale killing was going bravely on; that every rig for fumigation was in demand; that orchardists were each anxious to secure their turns; that a large number of groves had been completed; that the results of the work were not entirely uniform, owing, in part, to inferior cyanide used. A uniform grade of this article is necessary to secure the best results. The Commission has opened correspondence with every known manufacturing establishment in the United States to ascertain the percentage of cyanogen indicated by each brand.

Mr. Hamilton reported the same condition of things in his district. No compulsion has yet been found necessary. Each grower is anxious to learn the surest and most economical method of destroying the scale.

Mr. Keith reported a very different state of public sentiment obtained in his district (Anaheim). He stated that there were about fifty men in that district, the owners of trees badly infested with Red Scale, and that no one was willing to do anything for their destruction. Some claim that a perfect killing of every scale on every tree must be done, and that if the Commissioner would furnish such a remedy, then, and not till then, they would employ him to kill them. But no such remedy has yet been found and probably never will be. But the scale are on the trees just the same, and it is only a question of time when the trees will be destroyed, and that time is very short.

Others claim that they can not afford to kill the scale on account of the expense, unless their neighbors do the same; and so each makes excuse and nothing is done.

The unreasonableness of the demand for a perfect remedy needs discussion. If a remedy were ever so perfect the application of it must necessarily be imperfect. The causes are various and need no discussion. The Red Scale has come and that to stay. The best that can be hoped for it is to so reduce it as to make orange growing profitable. This can be done either with spraying or with fumigation. But skillful and thorough work must be done, no matter which remedy is used.

SWARMING OF A CRICKET AND A GROUND BEETLE IN TEXAS.

A letter, dated September 12, 1890, from Mr. G. H. Ragsdale, Gainesville, Tex., conveyed the information that a flight of crickets, accompanied by a small dark beetle about a half inch in length, visited his locality about the 9th and 10th of the month, particularly in the cities, appearing to drift in an easterly direction and showing themselves abundantly on the west walls of buildings. A second letter, dated Sep-

tember 19, from Mr. J. Reverchon, Rose Cottage, Dallas, Tex., reported them to have been very numerous in Dallas, and inclosed two clippings from the *Dallas News*, both dated September 11, which showed Fort Worth and Waco to have been particularly infested. They were especially attracted to the electric lights, and in Waco the stone base of the city hall was black with their moving masses. It was said that there were enough to make several cart loads. All-night restaurants were compelled to close. Large quantities of the crickets having been swept into the gutters, both there and in Fort Worth, they produced a nauseating stench.

Under date of October 4 Mr. Ragsdale sent us specimens of the cricket and of the beetle in question. The cricket belongs to an undetermined species of *Gryllus*, which we have had in the collection some time, both from Dallas, Tex., and New Orleans, La., and the beetle proves to be *Harpalus gravis*, Lec. Our first impression was that the *Harpalus* was attracted by the great numbers of the crickets and was feeding upon them, but it appears that in September, 1887, we received the same beetle from Fort Worth, from Mr. H. C. Edrington, with the statement that these beetles had made their appearance in the same part of Texas about the same time of the year for the past two years in immense numbers. Mr. Edrington made no remark about the accompanying crickets, and the occurrence of the *Harpalus* remains as much of a mystery as the swarming of the "overflow bug" (*Platynus maculicollis*) in California. We published an account of the swarming of this latter insect in Fresno County in the *American Naturalist* for August, 1882, page 681.

A PARASITE OF THE WILLOW CIMBEX.

Among a lot of specimens recently determined for Mr. Bruner was a specimen of *Opheltis glaucopterus*, a very large and handsome Ophionid, which we had previously collected and which Mr. Bruner had received from Mr. J. M. Aldrich, of South Dakota, who observed it ovipositing in *Cimbex americana*. The interesting point of this rearing, aside from the fact that the Cimbex has a parasite, is that this same parasite occurs also in Europe and is there an enemy of *Cimbex humeralis*, *C. femorata*, and *C. connata*.

ENTOMOLOGICAL SOCIETY OF WASHINGTON.

Nov. 6th, 1890.—Mr. Erwin F. Smith was elected a member of the society.

Mr. Schwarz exhibited a larva of the genus *Carabus* with deformed maxillary palpi. The right palpus is normally formed except that the suture between the first and second joints is nearly obliterated; the left palpus is only 3-jointed with the joints nearly transverse as in *Calosoma*.

Mr. Marlatt exhibited three female specimens of a species of the Tryphonid genus *Metopius*. The strikingly large and peculiar ovipositor of this species was described and reference was made to the literature relating to this genus from which it appears that the female has never been properly characterized if indeed it has ever been described at all.

Dr. Marx gave some additional notes on his experiments with the bite of *Lathro-dectus* but stated that the results had been wholly negative.

Mr. Howard read a paper entitled "The Habits of Pachyneuron," in which he referred to the breeding records of this genus of Chalcididae, recording twenty distinct rearings in North America, and made a number of interesting deductions therefrom.

Mr. Schwarz read a paper on the food habits of *Corthylus punctatissimus*. This Scolytid, previously known to infest the subterranean part of the stems of Sugar Maple saplings, was found in large numbers in the roots and subterranean stems of the common huckleberry, *Gaylussacia resinosa*, in the vicinity of Washington during September and October. In this connection Mr. Schwarz presented the description of a second North American *Corthylus*, *C. spinifer*, from semitropical Florida.

Mr. Marlatt presented a paper on the final molting of Tenthredinid larvae, in which he described the molting undergone by the larva of nearly all saw-flies after full-growth is reached and just prior to spinning up or entering the ground to pupate, describing also the accompanying change of color. Reference was made to the scanty literature of the subject and the explanation of this molt by Cameron on the ground of protection.

Mr. Townsend read a paper on the Leptid (Dipterous) genera *Triptotricha* Lw. and *Agnotomyia* Will. Mr. Townsend does not believe that the species of *Triptotricha* with only one front tibial spur should, without other distinguishing characters, be generically separated from those possessing two.

Mr. Fernow called attention to the ravages of *Gastropacha monacha*, particularly in Bavaria, stating that it has probably been introduced in the present instance from Italy.

General discussion followed on a novel method employed in Europe of collecting and destroying this Bombycid.

C. L. MARLATT,
Recording Secretary.

EDITORIAL NOTE.

In submitting for publication this number of **INSECT LIFE**, which is devoted entirely to the minutes of the Annual Meeting of the Association of Economic Entomologists, held at Champaign, Ill., November 11 to 14, 1890, we desire to state that its submittal for publication in this form is by the particular request of the association, which passed a resolution to that effect. The papers presented are of great and varied interest, the meeting was a most successful one, and, as the objects of the Association bear directly upon the subject to which this publication is devoted, we cheerfully comply with the resolution. It goes without saying that the editors of **INSECT LIFE** assume no responsibility for individual views and opinions in the papers presented at the meeting.

Number 6 of **INSECT LIFE** will be published almost simultaneously and will similarly contain the minutes of the section or committee of entomology of the Association of Agricultural Colleges and Experiment Stations.

PROCEEDINGS OF THE SECOND ANNUAL MEETING OF THE ASSOCIATION OF ECONOMIC ENTOMOLOGISTS.

The association met, pursuant to adjournment from the Washington meeting, at Champaign, Ill., in room 6 in the State University. Meetings were held on the 11th, 12th, and 13th, four sessions in all. The following officers and members were present during the meeting :

President C. V. Riley, Washington, D. C.
First vice president..... S. A. Forbes, Illinois.
Second vice president..... A. J. Cook, Michigan.
Secretary John B. Smith, New Jersey.

J. M. Aldrich, South Dakota ; W. B. Alwood, Virginia ; George F. Atkinson, Alabama ; M. H. Beckwith, Delaware ; Lawrence Bruner, Nebraska ; James Fletcher, Canada ; H. Garman, Kentucky ; C. P. Gillette, Iowa ; F. W. Goding, Illinois ; Charles A. Hart, Illinois ; F. L. Harvey, Maine ; L. O. Howard, Washington, D. C. ; John Marten, Illinois ; Herbert Osborn, Iowa ; F. H. Snow, Kansas ; H. E. Summers, Tennessee ; Roland Thaxter, Connecticut ; F. M. Webster, Indiana ; C. M. Weed, Ohio ; C. W. Woodworth, Arkansas ; also a number of others interested attended at times during the meetings, giving an average attendance of twenty-one.

MEETING OF NOVEMBER 11.

Dr. Riley in the chair ; seventeen members present. The secretary reported the correspondence had during the year and leading to the programme for the present meeting. He also read a letter from Alda M. Sharp, asking membership in the association. A statement that certain expenses had been incurred and would necessitate an assessment was made and submitted for action.

On motion of Mr. Cook, the report was accepted, and an assessment of 25 cents was made on each member present to pay the expenses incurred and to be incurred.

Mr. Forbes, from the Committee on Coöperation, presented a report of progress ; a full report could not be presented, because there was no committee of the main association to confer with. Until that body made some change in the organization of these permanent committees, giving them more time and scope, they recommended that the present status be retained and our organization be kept up. The committee had expressed the desire to coöperate, and in that respect its work was done.

On motion of Mr. Weed, the report was accepted as a report of progress and the committee was continued.

Considerable discussion was had as to the qualification of persons to be elected to associate membership. Messrs. Weed, Forbes, Smith, Alwood, Gillette, and Woodworth participated in this discussion. In the case of Dr. Packard, referred to a committee at the Washington meeting, the secretary was directed to enter his name on the list of members.

It was also decided that Dr. Kellicott was eligible to active membership; and, on motion of Mr. Cook, the secretary was directed to enter his name.

On motion of Mr. Weed, Mr. E. W. Doran was elected as associate member, having ceased since the time of his application for membership to hold an official position.

Mr. A. D. Hopkins, special agent of the West Virginia Station, was decided eligible to active membership, and his name was directed to be entered.

Messrs. J. M. Aldrich, Brookings, S. Dak. ; E. V. Wilcox, assistant at the Ohio Station ; and C. A. Hart, assistant at the Illinois State Laboratory, were entered as members at the suggestions of Messrs. Cook, Weed, and Forbes respectively.

The amendment to the constitution proposed by Mr. Forbes at the Washington meeting was taken up, discussed, and, on motion of Mr. Cook, adopted. Section 5 now reads as follows :

SEC. 5. The annual meeting shall be held at such place and time as may be decided upon by the association at the previous annual meeting, and special meetings may be called by a majority of the officers. Eight members shall constitute a quorum for the transaction of business.

The amendment relating to the change of the title of the Association, proposed at the Washington meeting by Mr. Lintner was taken up, discussed, and laid over for future action.

The association then adjourned.

MEETING OF NOVEMBER 12.

Twenty-nine persons present in the course of the session. The president read his annual address, as follows :

THE OUTLOOK FOR APPLIED ENTOMOLOGY.

GENTLEMEN : You have made it the duty of your presiding officer to give an annual address, a duty the less easy to perform for a new organization than for one which has a history behind it, and not facilitated by my absence in Europe at the time of your organization.

I had thrown together a sort of résumé of the results obtained during the year in economic entomology, more particularly by the entomologists of the different State stations, in the belief that this would be one of the most appropriate themes to present; but when I learned, from his circular of September 15, that Professor Forbes intended covering substantially the same ground, and that it was expected of him as one of his duties as chairman of the committee on entomology of the As-

sociation of Agricultural Colleges and Experiment Stations, it became evident that what I might present in that direction would be substantially anticipating and repeating what we may expect and hope to hear from him. I will endeavor, therefore, to touch upon a few matters unconnected with station work.

SOME RESULTS FROM THE NATIONAL DEPARTMENT AT WASHINGTON.

The hydrocyanic acid gas treatment against scale-insects is becoming more and more common in California, and has, to a certain extent, superseded the use of washes, especially against the Red Scale (*Aspidiotus aurantii*). This is largely due to the fact that recent experiments, carried on through Mr. Coquillett, have resulted in a great cheapening of the process: The expense has been reduced one-third, and the bulky machinery mentioned in my report for 1887 has been, for the most part, dispensed with. It has also been found that the use of the process at night is safer and more beneficial, in that it lessens the effect of the gas upon the foliage.

The repeated importation of scale-insects from Florida into California has attracted much attention. The species concerned are principally the Purple Scale (*Mytilaspis citricola*), the Long Scale (*M. glomerii*), and the Chaff Scale (*Parlatoria pergandei*). The fact that these insects must have been repeatedly imported into the State in past years without obtaining a foothold has been used as an argument against a quarantine, and a great deal of discussion on the subject has been had in the California papers. From my own observations in the State I am convinced that where the proper conditions of shade and moisture obtain there is no reason why these scale insects should not get a foothold, but that they will probably die out in the hotter, drier, and less shaded localities. An agent who was sent to Pomona to investigate certain newly planted orange groves of Florida trees found that while the trees were planted a year previously and had been dipped according to custom there in a caustic solution, every tree examined by him bore a few specimens of the purple scale. The excitement on this subject in California has been fostered by the claims of rival nurserymen engaged either in the importation of Florida stock or dealing in varieties grown at home, and from such contrary claims from persons prejudiced by their business interests it is difficult to extract the truth. A rigid quarantine not absolutely prohibitive were wisest, for great injustice might be worked by absolutely prohibitive restrictions. Careful inspection and thorough treatment, if they could be guaranteed, would prove an effective safeguard, but it were unsafe to trust to them without a rigid quarantine.

I have commenced a series of experiments upon the Black Scale (*Lecanium oleæ*), a species which, ordinarily occurring upon the Olive, has long damaged citrus fruits in California. The horticulturist of the Wisconsin Station, Mr. E. S. Goff, has modified the Nixon pump by adding

a tube so that kerosene may be drawn from one receptacle and a mixture of soap and water from another, thus forming a mechanical mixture in the act of spraying. This modification, at the request of Professor Henry, I have had tried in this series of experiments, and although it is too early to state the results, it may be said that so little time and labor are required in preparing a stable emulsion that this mechanical substitute will probably not come into general use. In this connection it may be observed that the formulæ recommended by some of our most voluminous writers are very misleading, and are calculated to produce only a mechanical mixture more or less unstable. The use of kerosene temporarily combined with water or soapsuds by mechanical means dates from many years back; it was a favorite remedy of my friend Thomas Meehan, who urged it in 1871 in the *Gardener's Monthly*; it was experimented with by others, and I used it successfully in 1872 against an undescribed Lecanium on Austrian pine, as also against Aphides on the place of Mr. Julius Pitman, of St. Louis, and in 1874 and 1875 against the congregated young of the Rocky Mountain locust. But the true and stable kerosene emulsion, which now forms one of the most satisfactory and widely used insecticides, and which requires two parts of the oil to one of the emulsifying agent, violently churned until a stable, butter-like emulsion results, was the outgrowth of my efforts in the investigation of the Cotton Worm, the milk having been first suggested in 1878 by the late Dr. W. S. Barnard while working at Selma, Ala., and the most satisfactory formula in 1880, from experiments which I had continued over two years by Mr. H. G. Hubbard on orange trees.

A locust outbreak of some interest has occurred in parts of Idaho and Utah and has been investigated by Mr. Bruner, the Nebraska agent of the Division. The species involved proved to be *Camnula pellucida*, which has overrun the strip of country 140 miles in length by from 15 to 30 in width, commencing at a point about 30 miles westward of Soldier, Idaho, and extending east as far as East River and Birch Creek. The people in these sections are quite willing to do whatever can be done to destroy these insects; but they need instruction. The country has been largely settled since the publication of the early reports of the U. S. Entomological Commission and the new settlers lack experience in dealing with locusts; for fifteen years make great changes in the rapidly growing West. I have, therefore, in preparation a bulletin treating of the several species of locusts which are responsible for these frequent scares and which will include, at the same time, a summary of the practical portions of the earlier reports of the Entomological Commission on *Caloptenus spretus*, long since out of print.

The Army Worm proved injurious in several localities during the past year, particularly in Maryland and Indiana. The Maryland occurrence is of considerable interest, owing to the fact that the preceding year was one of unusual precipitation throughout the Atlantic States, though with some remarkable local exceptions. Indeed one of the parties who

suffered from the Army Worm in Maryland reported the previous summer as dry in his locality, and these local outbreaks, if we could get at all the circumstances, would doubtless be found not to conflict with the general laws governing Army Worm increase, which I have stated in the third report of the U. S. Entomological Commission, and were promoted by the extremely mild winter, which promoted the constant growth and development of the hibernating larvæ.

The notices in INSECT LIFE and the *Entomologist's Monthly Magazine* of the damage caused by a new bark-louse to the gardens of Alexandria, Egypt, have attracted considerable attention and Mr. J. W. Douglas has described the new depredator as *Crossotosoma ægyptiacum*. A study of Mr. Douglas's description and figures has convinced me that this insect is an *Icerya* and that its spread is greatly to be feared, judging from our experience with *I. purchasi*. Moreover, three additional species of this genus have been brought to my notice during the year; one occurring in Mexico on grapevine, another in Key West, Fla., upon roses and other garden plants, and the third in the island of Montserrat, West Indies, upon the cocoa palm, the banana, and a species of *Chrysophyllum*. These interesting and injurious insects have been investigated so far as could be done by correspondence, and descriptions, with figures, will be published in the forthcoming number of INSECT LIFE.

The sugar-beet industry, after a quarter of a century's vicissitude, has begun a substantial and permanent growth, especially in Nebraska. It has been found that the crop is speedily attacked by insects, and Mr. Bruner, being advantageously located for work of this kind, has during the past summer paid some attention to the insect enemies of this crop and has already a list of sixty-four species, most of them being leaf-eaters and such as are commonly found upon various allied succulent plants—one of the worst being the Garden Web-worm (*Eurycreon rantalis*).

THE HOP PHORODON.

One of the most interesting facts of the year has been the occurrence of the Hop Fly (*Phorodon humuli*) in the extreme Northwest, especially in Oregon and Washington, so soon after my note of warning as to the danger of its introduction to the hop fields of that section, and the need of precautionary measures that might prevent such a calamity. The soil and climate of southern Oregon seem particularly adapted to the growth of the Hop, as it is already the leading crop in Lane, Marion, Polk, and other counties.

There can be no doubt about the species, because Mr. F. L. Washburn, the entomologist of the experiment station, has given it some attention, and I have also received specimens from him and from Mr. A. Todd, of Eugene, Oregon, as also from Mr. Giles Farmin and Mr. G. M. Stratton, of Puyallup, Wash.

Mr. Washburn, from the fact that it has been noticed that hops were sometimes not so much affected in the immediate vicinity of plum trees as some distance away, and from the further fact that some of the growers reported that they never saw the insect on the Plum, indicates that there must be a different state of affairs in Oregon, so far as the life-cycle of the insect is concerned, from that which prevails in the Eastern States and in Europe. Absolute and experimental proof of facts obtained after long and persistent investigation should never be lightly questioned. It is by no means an uncommon experience that hop plants in the immediate vicinity of plum trees are not more affected than, or as much as, others at a distance, and this may depend on the direction of the wind or on local circumstances, or on the variety of plum, whether wild or cultivated. I have examined in vain certain cultivated plum trees for evidence of *Phorodon*, whereas I have invariably found it upon other varieties in the same vicinity. *Phorodon humuli*, in common with all other Aphidids, preferably chooses, when migrating, certain genial days, and often fills the air, flying great distances. In perfectly calm weather the migrants settle almost everywhere, but they are easily affected by the least breeze and are wafted in different directions. The invasion of a hop-yard may be from plum trees miles away to windward, and we may depend upon it that the species will migrate to and from *Prunus* in the Northwest as it does in the East.

PHYLLOXERA.

The Grape Phylloxera has continued to attract the attention not only of most European Governments but also of those of Australia and New Zealand. It continues its spread in France, having at last invaded the more valuable champagne districts. The last report of the Superior Phylloxera Commission of that country shows that about 240,000 acres have undergone defensive measures, submersion being employed in 72,000, bisulphide of carbon in 145,000, and sulphocarbonate of potassium in 23,000. The work is practically at an end in such Departments as Hérault, Gard, and Gironde, where the American resistant vines have most effectually been used; while the wine growers of Algeria, Spain, Italy, Portugal, Hungary, Austria, and Switzerland are all battling against it, and are all more or less aided by their respective governments.

The advent of the insect in New Zealand has been the cause of much writing and of much legislation there, and the government has been quite anxious to get the best and latest information on the subject. There is very little that is available in the way of published experience in this country, as my Missouri reports are now very difficult to obtain. I would repeat here in substance what I have recently written to Mr. F. D. Bell, agent-general at London for New Zealand, because the demand for the information is continuous, and our own people are, to a great extent, unfamiliar with the facts.

During the more than twenty years' struggle in France against the species innumerable remedies have been proposed, most of which have proved to be absolutely valueless. A few measures have been devised, however, which, under proper conditions, give fairly satisfactory results. These consist in (1) methods which avoid the necessity of direct treatment, comprising the use of American stocks and planting in sandy soils; (2) the employment of insecticides (bisulphide of carbon, sulphocarbonate of potassium, and the kerosene emulsion); and (3) submersion.

It was early found in the history of this Phylloxera that most of the cultivated varieties of American grapevines, as also the wild species, resisted, or were little subject to, the attacks of the root form (*radicicola*) of the Phylloxera, although the leaf gall form (*gallicola*), which in point of fact does little if any permanent damage, occurs in greater numbers on many of our wild and cultivated sorts than on the European grapevines, which are all derived from the single species, *Vitis vinifera*, and which are so exceedingly subject to the attacks of the root form. This fact was first noticed in France by M. Laliman, of Bordeaux, and later by Gaston Bazille, of Montpellier, and was independently proved on a more extended scale by my earlier investigations in the United States. The use of American stocks upon which to cultivate the susceptible European varieties has resulted in an enormous trade in certain American seeds and cuttings and now supersedes all other methods against the insect.

It was my privilege and pleasure to spend a week in August, 1889, among the world-renowned Médoc and Sauterne vineyards of the Bordeaux district in France. Here, by virtue of the rich alluvial soil and the ease with which the chief vineyards can be submerged, the Phylloxera has made slower headway, and the opposition to the use of American resistant stocks has been greatest. Yet they have finally vanquished prejudice and are, either from necessity or choice, rapidly coming into general use. When I say choice, I mean that even where the French vines yet do well and the Phylloxera is kept in subjection by other means it is found that great vigor of growth and increase in healthfulness and yield of fruit result at once from the use of American stocks.

Without going into a lengthy discussion of the subject of wild American species, those of practical importance to the grape-grower are the following: *Vitis æstivalis*, *V. riparia*, and *V. labrusca*.

The varieties derived from *V. æstivalis* are of value for their fruit as well as for their resistant qualities, and, being easily propagated from cuttings, they are very often used in France as stocks. The most important varieties are Jacquez, Herbemont, Black July, and Cunningham.

The varieties of *Vitis riparia*, both wild and cultivated, are, on account of their special fitness, almost exclusively employed in France as resistant stocks, for which they easily take first rank. The varieties

used are, first, the wild forms; and, second, the cultivated varieties Solonis, Clinton, and Taylor. Of the cultivated varieties, the Clinton was one of the first vines tried for this purpose and has been extensively used with fair satisfaction. The Solonis now ranks above it, but is valueless for any other purpose on account of the acidity of its grapes. In California, the Lenoir, Herbemont, and Elvira have been used, but late experience shows that the wild *Riparia* is most satisfactory there, as it is in France.

The different varieties of *Vitis labrusca* are less resistant to the Phylloxera than those above mentioned. Certain varieties have, however, been grown successfully in France, and of these the Concord has given much the best results; but others, Isabella and Catawba for example, succumb there to the root-louse, as indeed they do in many sections of this country.

Of the many valuable hybrids obtained from the American species of *Vitis* which are serviceable as stocks, the more important are the Elvira, Noah, and Viala. The last named, perhaps of all the resistant varieties, gives the greatest percentage of successful grafts, and is admirably adapted for grafting on cuttings.

Early in the study of the subject it was found that the nature of the soil has a very marked influence on the success of the different stocks. The subject has now been quite fully investigated in France, and the latest researches are formulated by the experimental school at Montpellier in the statement quoted below, which will be of interest as giving the various classes of soils, together with the American vines best adapted to each.

(1) New, deep, fertile soils: *Riparia* (tomentous and glabrous), *Jacquez*, *Solonis*, *Viala*, *Taylor*, and *Cunningham*.

(2) Deep soils, somewhat strong, not wet: *Jacquez*, *Riparia*, *Solonis*, *Cunningham*, *Viala*, *Taylor*.

(3) Deep soils of medium consistency, new and not dry in summer: *Riparia*, *Jacquez*, *Solonis*, *Viala*, *Taylor*, *Black July*.

(4) Light pebbly soils, deep, well drained, and not too dry in summer: *Jacquez*, *Riparia* (wild), *Taylor*, *Rupestris*.

(5) Calcareous soils, with subsoil shallow or granitic: *Solonis*, *Rupestris*.

(6) Argillaceous soils, white or gray: *Cunningham*.

(7) Argillaceous soils, deep and very wet: *V. cinerea*.

(8) Deep, sandy, fertile soils: *Riparia* (wild), *Solonis*, *Jacquez*, *Cunningham*, *Black July*, *Rupestris*.

(9) Light pebbly soils, dry and barren: *Rupestris*, *York*, *Madeira*, *Riparia* (wild).

(10) Deep soils, with a tufa base and salt lands: *Solonis*.

(11) Soils formed of debris of tufa, but sufficiently deep: *Taylor*.

(12) Ferruginous soils, containing red pebbles of silicia, deep and somewhat strong, well drained, but fresh in summer. All the varieties indicated, and in addition: *Herbemont*, *Clinton*, *Cynthiana*, *Marion*, *Concord*, *Herman*.

The accompanying table from the last report of the Superior Phylloxera Commission indicates, better than words can tell, the steady growth in the use of American vines.

Years.	American vines covered.	Departments.
	<i>Acres.</i>	
1881.....	22,000	17
1882.....	42,700	22
1883.....	70,000	28
1884.....	131,909	34
1885.....	188,200	34
1886.....	276,900	37
1887.....	413,700	38
1888.....	536,900	43
1889.....	719,500	44

On the subject of direct remedies the value of the kerosene emulsion for this purpose has not been properly realized in France, because of the relatively high price of petroleum in her grape-growing *Départements*. A series of experiments which I made in 1883 showed conclusively its great value for this purpose, as it not only destroys the insect in all stages, but also stimulates root growth.

In this connection I have recently had a series of experiments made through Mr. Albert Koebele's agency, in the Sonoma Valley, California, to ascertain the effect upon the Phylloxera of certain of the resin washes which proved so valuable when used against the Fluted and other scale-insects. The results have been quite encouraging and the experiments have already shown that in the use of those washes we have a valuable addition to the underground remedies. Soaps were made by the use of bicarbonate of soda, sal soda, and caustic soda, each mixed with resin. In the earlier experiments the earth was removed about the base of the vine to a depth of 6 inches and for a diameter of 4 feet. Ten gallons of the mixture were poured into each hole and found to penetrate from 12 to 16 inches or from 18 to 22 inches from the original surface of the ground. Most of the insects, as also the eggs, were destroyed to a depth of 16 inches. In the later experiments the holes were made only about 2 feet in diameter, and nearly, if not quite, the same results were obtained with half the amount, or 5 gallons of the mixture. The plan, which I have previously adopted for the application of insecticides to underground insects, of washing the mixture in with pure water was tried with good success. Soon after the first application 5 gallons of water were added, and 5 gallons more the following day. This would indicate that in the spring, when rains are frequent (occurring almost every day) in the Sonoma Valley, only a small amount of the mixture need be applied, and the rains will do the rest, as examination has shown that up to a certain point each application of water intensifies and extends the action of the original insecticide. The best soap was made with bicarbonate of soda, but the re-

sults of that made with caustic soda are so little inferior, while the price is so much less, that the caustic soda and resin soap mixture is the one which I would recommend. The formula which was found preferable is as follows :

	Pounds.
Caustic soda (77 per cent.)	5
Resin	40
Water to make 50 gallons.	

The soda should be dissolved, over a fire, in 4 gallons of water, then the resin should be added and dissolved. After this the required water can be added slowly, while boiling, to make the 50 gallons of the compound. To this water may be added at the rate of 9 gallons for 1, making 500 gallons of the dilute compound, sufficient for one hundred large vines, at a cost of only 84 cents, or less than a cent a vine.

Considering the effective way in which the ravaged vineyards of France have been, and are being, redeemed by the use of resistant American stocks, and considering the efficacy of some of the direct remedies discovered, it is passing strange that no disposition has ever been made of the premium of 300,000 francs offered in the early history of the trouble by the French Government. It can not be awarded to any one person, but should be distributed among those whose labors and discoveries resulted in the several feasible and satisfactory methods of coping with the insect.

INTRODUCTION OF PARASITES AND PREDACEOUS SPECIES.

The success which has attended the introduction from Australia of *Vedalia cardinalis* has been phenomenal. Indeed, few who have not kept in knowledge of the reports and the actual condition of things can appreciate the remarkable character of the results, not only because of the brief period required therefor, but because of the thoroughness of the work of the little ladybird and the moral and financial benefit to orange growers which have followed in its wake.

The striking success of the experiment has served to fix attention, not only of entomologists, but of fruit growers and farmers, to this mode of dealing with injurious insects, and there is no question but that the cases in which the experiment may be more or less successfully repeated are numerous. Let us hope, therefore, that the moral effect will be as great as its practical effect in opening up means and ways in the future, as it should serve to remove the disposition to deride any expenditure having such results for its object. Many fears have been expressed lest after sweeping off the *Icerya* the *Vedalia*, being so far as we now know confined to that species for food, should perish and that the *Icerya*, preserved in some restricted places undiscovered by its enemy, would again multiply and become destructive.

I firmly believe what I wrote in my last annual report as United States Entomologist, viz :

We may hardly hope, however, that the last chapter in the story is written. On the contrary, it is more than probable, and in fact we strongly anticipate that the *Icerya* will partially recuperate; that the *Vedalia* will, after its first victorious spread, gradually decrease for lack of food, and that the remnants of the Fluted Scale will in the interim multiply and spread again. This contest between the plant-feeder and its deadliest enemy will go on with alternate fluctuations in the supremacy of either, varying from year to year according to locality or conditions; but there is no reason to doubt that the *Vedalia* will continue substantially victorious, and that the power for serious harm, such as the *Icerya* has done in the past, has been forever destroyed. We have learned, also, that it will always be easy to secure new colonizations of the *Vedalia* where such may prove necessary, or even new importations should these become desirable.

During the year I have endeavored to return the favors received from Australia and New Zealand by sending there some of the natural enemies of the Codling Moth, and from last accounts, though jeopardized by the action of the custom-house authorities, the experiment promised success so far as a species of *Raphidia* from California is concerned. I have also endeavored to introduce some of the parasites which attack the Hessian Fly in Europe, and which do not yet occur in this country. These efforts have been made by correspondence, for you will be surprised to learn that the restrictive clause in the appropriations to the Department of Agriculture for entomological work, which limits traveling expenses to the United States, is still maintained in the face of the *Vedalia* experience, where by the expenditure of \$1,500 many millions were saved. The maintenance of this restricting clause in the last appropriation bill, under these circumstances, is a travesty on legislative wisdom, and all the more remarkable because done by the Senate in opposition to the House and the recommendations of both the Secretary and Assistant Secretary of Agriculture.

While there is much to be done in this direction in future I can not let this occasion pass without giving a note of warning. Success will only come in any particular case when exact knowledge is first obtained and the most thorough scientific methods are then adopted; and we can not too severely condemn everything that savors of bunkum and ignorance. During the year the press of the country has prominently heralded the fact that a gentleman from San Francisco, especially charged to study certain entomological matters in the East, found, while in Washington, the Two-spotted Ladybird (*Coccinella bipunctata*) feeding on "the Aphis" right under the windows of the Division of Entomology of the Department of Agriculture, the inference intended being that the entomologist and his assistants were ignorant of the circumstance. Indeed a writer in one of the California papers of recent date announced this discovery under the sensational heading "Another good bug—the Woolly Aphis has found its Sedan." How supremely ridiculous this sort of thing appears to the well-informed entomologist

I need not tell you, but it may be well for the information of the public to say (as I have not alluded to the matter elsewhere) that a number of different species of ladybirds feed upon the Woolly Aphis and that it is a rule with the insects of this family not to be select as to the particular Aphid they prey upon. *Hippodamia convergens* (the species referred to as the Sedan of the Woolly Aphis) feeds over nearly the whole extent of the United States upon this particular *Schizoneura*, among others, and the fact that both the species referred to feed upon various aphides is well known. That one of the species is also common upon the Pacific coast and that its being carried there from the East is like "carrying coals to Newcastle" may not, however, be so generally known. All such efforts as this carried on by persons unfit, from want of any special knowledge, for the mission, must invariably do harm, not only because of the negative results which follow, but because of the lack of confidence in such work which they will engender in the minds of our legislators.

I should not think of holding any one responsible for newspaper paragraphs, but in this case the party has substantially confirmed them in statements over his own name and in interviews which (as announced) he has himself revised.

METHOD OF USING BISULPHIDE OF CARBON AGAINST GRAIN WEEVILS.

The use of bisulphide of carbon against different insects attacking stored grain has greatly increased in this country since I first recommended it some thirteen years ago.* There is, however, considerable diversity in the method of using it and the recommendations of some of our writers have evidently been made with no sense of the fact that the fumes are heavier than air and descend rather than ascend. Prof. A. H. Church in a recent number of the *Kew Bulletin* records that he found that $1\frac{1}{2}$ pounds of the bisulphide is enough to each ton of grain. He advises that it be applied in the following way:

A ball of tow is tied to a stick of such a length that it can reach the middle of the vessel containing the grain. The tow receives the charge of bisulphide, like a sponge, and is then at once plunged into the vessel and left there, the mouth or opening of the vessel then being tightly closed. When necessary, the stick may be withdrawn and the charge (of 1 ounce to 100 pounds of grain) may be renewed.

The action of carbon bisulphide lasts in ordinary cases six weeks, after which period a fresh charge is required. The bisulphide does no harm to the grain as regards its color, smell, or cooking properties and the germinating power of most seeds is not appreciably affected, provided that not too much is used, nor its action continued for too long a period.

* *Farmers Review* (Chicago), March, 1879.

The assistant director of agriculture of Burmah is reported to have used naphthaline instead of bisulphide in the following way, but I should not expect anything like as good results from the naphthaline as from the bisulphide:

A hollow bamboo cylinder $1\frac{1}{2}$ inches in diameter with a stick fitted into the cavity is pushed down to the bottom of the bin, the stick is then withdrawn and a few teaspoonfuls of naphthalin powder is poured into the bamboo, which is then drawn out leaving the naphthalin at the bottom of the bin. If the bins are very large this should be done once to every 10 feet square and the application should be repeated every fifteen or twenty days.

INSECTICIDE MACHINERY.

A profitable hour might be devoted to the subject of insecticide machinery, but I must content myself with a few words. At a trial of such machinery at the Mareil-Marly vineyards during the late Paris Exposition I had an excellent opportunity of witnessing the latest advances made in France in this direction, and it was extremely gratifying to note that, with whatever modification of the power employed (and many of the machines were very ingenious), all other forms of spraying tip had been abandoned for vineyard purposes in favor of modifications of the Riley or Cyclone nozzle. The superiority for most practical purposes of the portable knapsack pumps of V. Vermorel, of Villefranche (Rhône), France, was sufficiently evident. Mr. Vermorel has indentified himself with the regeneration and improvement of French grape culture in many directions, and is, withal, an enthusiastic student of insect life. I spent a very profitable day with him last year, both at the factory and at his home, where he has established a virtual experiment station in the midst of a fine vineyard on American roots, and with every facility for various fields of investigations, none of which are deemed more important than the work in entomology, for he fully realizes how much there is yet to learn of some of the commonest insects destructive to the vine even in an old country like France. But in no direction has he accomplished as much good as in his work with insecticide and fungicide machinery. His sprayer with independent pump, his diaphragm pump—L'Eclair—and his reservoir with suction and force pump are all admirably adapted for the purpose they were invented for and may be obtained in France at a cost from \$5 to \$7 which is tripled before reaching this country, thanks to our present tariff system.

The last number of the Journal of Mycology, the serial publication of the Division of Vegetable Pathology of the Department of Agriculture, gives full description, with figures, of a knapsack spraying apparatus, for which the special merit claimed is cheapness, and which is named the Galloway Sprayer.

The combination of a suction and a force pump with knapsack reservoir has been frequently made in France, as illustrated by the appara-

tus styled the "Cyclone" of Vermorel; the Japy, Vigeroux, Nougès and Perrin sprayers, and the sprayer of the society "L'Avenir Viticole." A number of pumps manufactured in this country of this style were mentioned or described in the Fourth Report of the U. S. Entomological Commission. These, in general, are much inferior to the French pumps named, which are, however, modeled after those earlier and cruder forms. There are a host of other French knapsack spraying machines which differ from those mentioned, by propelling the liquid by means either of air pumps, diaphragm pumps, or devices in which the pump is attached to the reservoir by means of a rubberhose.

In 1888 Mr. Adam Weaber, of Vineland, N. J., brought out the Eureka sprayer, a very serviceable knapsack pump modeled after the French machines. The French sprayers will cost, including duty, shipping, etc., from \$18 to \$25; the Weaber sprayer is sold for \$21, which is but little more than the cost of manufacture. Professor Galloway's machine is sold for \$14, or from one-fourth to one-third less than the Weaber or the French sprayers.

In the first announcement of this pump in No. I, vol. 6, of the publication cited, and in the later full description, no statement is made of the indebtedness of the inventor to these older machines, except in the case of the original description of the lance and nozzle (*op. cit.* vol. 5, No. II), where credit is given. This naturally gives the impression that the apparatus is novel in many or all its features.

When compared with the French machines the following facts become apparent:

1. The reservoir is practically identical with that of the Vermorel, Japy, and other French machines, and the opening for introducing the liquid with strainer and lid presents no new features.

2. The pump is an ordinary double cylinder (or hollow piston) force pump; the hollow piston furnishing an air chamber which causes the liquid to be forced out in a continuous stream.

3. The lance and nozzle combination consists of the Riley nozzle fitted to a lance and provided with a degorging apparatus, which also acts as a stop cock model exactly after Raveneau's apparatus, and is practically the same as the Japy degorger and stop cock, except that the action is reserved. In the latter (see INSECT LIFE, vol. 1, p. 265, fig. 61) the spring normally closes the discharge orifice, and in the former the orifice is normally open and is closed by the action of a lever in the spring.

That this modification of the foreign knapsack sprayers will prove a serviceable one for vineyard work, and by reason of its cheapness and availability come into general use, I have little doubt.

STRAWSON'S AIR-POWER DISTRIBUTOR.

A new and distinct type of insecticide machine, the invention of Mr. G. F. Strawson, Newbury, Berks, England, has attracted no little attention—15738—No. 5—2

tention and has received numerous awards during the past two years at various agricultural shows in England, and has been very favorably noticed and recommended by competent judges. It was shown at the late Paris Exposition and was thoroughly tested before a select jury, from which it received the highest praise and was awarded a gold medal. I had occasion to study it thoroughly not only at Paris but at the Royal Show at Windsor, and am under obligations to the inventor for courtesies and facilities afforded.

In common with all the heavier and more expensive machines, it will have to contend with the more popular and less expensive portable machines. It has many advantages in the control of the volume and character of what it disseminates; and with some modifications and adaptations for nether spraying, it would prove extremely serviceable in extensive fields of any crop that needs such spray and where the rows are relatively straight and the plants low. The principle also is a good one, and applicable, with modifications, to many other uses.

The machine is called the "Strawsonizer," and is a pneumatic or air-blast distributor, and may be adapted to a variety of uses, such as broadcast sowing of grains, distribution of fertilizers or of disinfectants in cities, and of dry or liquid insecticides.

The machine is light, simple in construction, and easily operated by one man, the larger sizes being drawn by one horse and the smaller by hand power. It is constructed largely of wood, and is mounted on two iron wheels. The distributing power is obtained by a blast of air produced by a revolving fan worked by the traveling wheels of the machine.

The essential part consists of a suitable receptacle or hopper, either for liquid or dry substances, from which the material is fed automatically and regularly to the blast generated by the revolving fan, the whole operated by suitable gearing. A receptacle for either dry or liquid material can be employed in connection with suitable nozzles or deflecting devices on all the machines, so that with practically one apparatus all the kinds of work indicated above can be accomplished.

For solids a metal spreader is used, while for liquids nozzles of the direct discharge type, but variously arranged to suit different requirements, are employed.

Very uniform and rapid work may be done with this machine in broadcast sowing of wheat, oats, and smaller seeds. These are distributed with great regularity over a track 18 to 20 feet wide, giving a rate of 30 to 40 acres per day. It is especially serviceable as a distributor of fertilizers (phosphates, nitrate of soda, lime, etc.), and all insecticide powders, which latter may frequently be applied in connection with the former substances.

Liquid insecticides are distributed broadcast at a rate of from 1 gallon upwards per acre, and by the action of the powerful blast of air are broken up into a fine mist, which spreads uniformly to a width of 20

feet. Nozzles for upright or lateral spraying would adapt the machine for work in hop-fields or orchards.

A patent for the apparatus has recently been taken out in this country, but its manufacture here has not so far been inaugurated.

The one horse power machine for broadcasting grains, fertilizers, and either solid or liquid insecticides with suitable receptacles and nozzles is retailed in England for £30 sterling, or \$150. If fitted with special nozzles for vertical work £2 extra are charged. Hand-power machines are sold for £12 and £14. These prices would be even greater in this country, and would doubtless interfere with its adoption were it not that it combines the other advantages indicated.

INTERNATIONAL INTERESTS.

With the constantly increasing facilities for intercommunication between different parts of the globe the results obtained and experiences had in one part are soon available for the rest of the world. Thus France has more than repaid the United States for the good—however vast and important—that has resulted to her by the use of American resistant stocks. Her experience with these American vines has reacted beneficially upon our own viticulture in many directions, but particularly in the great advance which her sons have made in insecticides and fungicides and in convenient, portable insecticides, and fungicide appliances. It has often been said of the French that they are not an originating people; however that may be, they are very quick at adopting and improving ideas and discoveries once brought to their notice, and no nation is more appreciative of the immense practical benefits to be received by the adoption of the most scientific methods. In fact no nation has given greater Government incentive to the pursuit of science in its bearings upon the welfare of mankind, and we may study with profit what she has of late years done in our own line.

I had a delightful visit last August from Mr. John West, who came to this country as a delegate from Victoria to ascertain all he could of our methods; also from Mr. W. Catton Gasby, of Adelaide, who came to this country in a similar capacity. Economic entomology in their part of the world is extremely interesting to us; for while the seasons are reversed as compared with ours many of the same injurious insects occur in both countries. Thus I was glad to get perfect confirmation from Mr. West of the fact that the Northern Spy and the Winter Majetin are found to protect the apples grafted upon them from the Woolly Aphis. A great deal has been published of late years in the New Zealand and Australian papers on "blight proof" apple stock, and they have had an important experience, the outcome of sore necessity, for *Schizoneura lanigera* has there been one of the most serious drawbacks to apple culture.

There can be no question but that this experience will prove of value to our apple-growers wherever these varieties grow well and the woolly

aphis abounds. The use as stocks of such varieties as enjoy immunity from the Woolly Aphis has occurred to our own people, but no such extended experience has been had in regard to any particular resistant varieties. Some of our injurious insects are often worse in Australia than they are with us, and we may expect to reap the benefit of the experience had there with regard to them. This will doubtless be true not only of the Codling Moth but of their peach aphis, which, from all that I can learn, is substantially the same species as that which does so much damage in our lighter soils along the Atlantic coast, and which Dr. Erwin F. Smith, of the Division of Mycology of the Department at Washington, has carefully studied lately and described in great detail as a new species under the name of *Aphis persicæ niger*, but which I have reason to believe is the *Aphis prunicola* of Kaltenbach.

The Italians have been making a very interesting fight against an insect which has threatened their very important and extensive silk industry, by its attacks upon the mulberry tree. This insect was described by Targioni Tozzetti in 1885 as *Diaspis pentagona*. It occurs upon a number of different trees, among them the paper mulberry, the spindle tree, the peach, the cherry, laurel, and certain willows, as well as upon the cultivated white mulberry, and it would seem that its taste for the latter tree is one recently acquired, judging from the late date at which the habit has attracted attention. The energetic director of the entomological experiment station at Florence investigated the pest in 1886 and recommended the use of mechanical means at the time of hatching of the young, viz, the scrubbing of the trunks and larger branches with stiff brushes and a subsequent application of a mixture of soap and water with 4 or 5 per cent. of kerosene.

Professor Franceschini, the editor of the *Rivista de Bacchicoltura*, recommended the adoption of the Balbiani formula as used against Phylloxera and consisting of crude tar oil, naphthalin, quick lime, and water, the naphthalin being dissolved in the tar oil, and the water and lime afterward added together. The insect appeared first in several cantons of the province of Como and speedily spread to the adjoining localities. The matter was brought to the attention of the Ministry of Agriculture and a commission was appointed, consisting of Prof. Targioni Tozzetti, Dr. Alpe, and Dr. Andres, who immediately familiarized themselves with the methods in use in this country and have made extensive experiments with our kerosene emulsion, with our fumigating processes, and with other new remedies. The subject has been taken in hand with great vigor and the Government has interested itself to the extent of appointing inspectors in the different communes in the infested territory and establishing regulations which oblige the immediate report of new localities and the adoption of measures of extinction when ordered by inspectors. These regulations also provide that the inspectors must do the work at the expense of proprietors when the latter refuse to do so; they prohibit the exportation of leaves from infested localities to others,

and provide for indemnity to owners for the destruction of trees when the degree of infection is such as not to threaten the ultimate life of the trees. Expenses for experiments of all kinds and for the watching and care exercised by agents are borne by the State, while the expense for the execution of certain of the regulations are borne one-third by the proprietor and two-thirds by the local society. A fine for disobedience of the regulations is also provided for. The laws, as published, are none too severe considering the urgency of the case, and it is refreshing to notice the energy with which the Government has met the threatened danger, and at the same time gratifying to note the appreciation shown of our own means and methods.

USE OF CONTAGIOUS GERMS IN THE FIELD.

Most of you are aware that I have not had the greatest faith in the availability of contagious disease germs as a means of battling with injurious insects in field, garden, orchard, or forest; there are so many delicate questions involved and so many obstacles in the way of practically carrying out any plan, however plausible theoretically or true in principle. Our ability to contaminate healthy by diseased specimens is but a short step and leaves many important questions, as of rapid dissemination, untouched. The theory is very tempting and has been particularly dwelt upon by some who were essentially closet-workers, having but faint realization of the practical necessities of the case. Theoretically, with those insect diseases of a cryptogamic nature, having a complex life-history and a resting spore, the difficulties are greater than with those of a bacterial origin, and it is to these last that we should look for important aid if it be available. Yet if the work of Messrs. Lugger and Snow should be fully substantiated, the best results have so far been obtained with the entomophthora of the Chinch Bug. No one will be more pleased to have his doubts dissipated by some tangible evidence of the practicability of this method than myself. Success, if possible, will come only by investigation upon thoroughly careful and scientific lines, such as those begun and still pursued by Professor Forbes. The ease with which he conveyed the Silk Worm pebrine to other larvæ; his conveying the Cabbage Worm *Micrococcus* to other larvæ, and his carrying this *Micrococcus* in cultures over winter are promising facts, as is also Professor Osborn's contaminating cabbage worms in Iowa with specimens brought from Illinois. Congress, having at its last session appropriated \$2,500 for some further investigation of the Boll Worm, the possibilities in this direction for this particular insect have caused me to plan investigations having for their object thorough field experiment with some of these disease germs.

Heliothis armigera is one of those cosmopolitan insects which has become more injurious in the United States than in any other part of the world, by virtue of its partiality for green corn, green cotton bolls, and green tomatoes. The polyphagous and partially endophytous habit of

the larva renders its destruction difficult except during the earlier free-living stages by the fine spraying of the arsenites on the under surface of the leaves. The ideal treatment for the larger burrowing worms were some rapidly spreading disease germ that would penetrate and destroy them in their hidden recesses. The insect was reported as extremely abundant in cotton bolls during the summer, especially in Texas; but by the time the appropriation became available its numbers had decreased, and it was too late in the season to do much more than prepare for next year. We may expect, as a result of special investigation much additional fact and experience both as to habits, natural enemies and means of control; but it is my desire to make the trial of these disease germs the special feature of the investigation. Of those employed in the investigation, Mr. F. W. Mally was a former assistant to Professor Forbes and has some experience in the study and culture of disease germs, while Dr. A. R. Booth is something of an enthusiast on the subject and has already established the susceptibility, through contact, of the Boll Worm to the Cabbage Worm *Micrococcus (M. pieridis)* of Burrill. We hope to carry the germs through the winter so as to continue the experiment as early as possible next year.

I have had in mind as probably the most promising germ, that which affects *Nephelodes violans* in a similar epidemic way, but which, as Professor Forbes informs me, is a quite distinct *Micrococcus*, and I shall be pleased to have any of you coöperate with me next year, by informing me of any disease of this character that may prevail in your several localities.

APICULTURE.

While little attention has so far been given by the different stations to the subject of apiculture, except at Lansing, it is nevertheless an important branch of economic entomology, and there is much promise of good results yet to come from careful experiment and investigation. One of the most inviting fields is the search for and introduction of new varieties or species of bees; for just as American apiculture has profited in the past by the importation of races like the Italians, Syrians, and Carniolans, there is every prospect of further improvement by the study and introduction of such promising races as are either known to occur or may be found in parts of Africa and Asia. *Apis dorsata* is believed to have many desirable qualities, and private efforts have already been made to introduce it and have failed chiefly for want of means. The further study of desirable bee forage plants and the introduction and acclimatization of such as are known to be valuable to parts of the country where they do not yet occur, are very desirable.

Much has yet to be done also in the line of systematic breeding, and we should be able to make rapid advances in the amelioration of existing races by proper selection, if we could assume practical and ready control of the fertilization of the queen. In these directions we are now plan-

ning, with Prof. Cook's aid, some effective work, but the introduction of foreign bees, which the Department should be able to undertake to better advantage than any private individual or State institution, is rendered more difficult by virtue of the restrictions in the appropriation already alluded to in discussing the subject of the introduction of parasites; and whatever is done in the other directions by the National Department will be done most advantageously through the coöperation of one or more of the State stations, many of which are far better equipped and more favorably situated for apicultural work than the Department at Washington.

SILK CULTURE.

This, again, is an important part of applied entomology, and, as most of you know, I have for many years worked toward the establishment of silk culture in this country. The result of these efforts has served only to convince me of the utter impossibility of successfully entering upon the enterprise on a business basis without protective duty on the reeled, or misnamed "raw" silk. Some five years ago, largely through the then Commissioner's appeal, based on my own report and assurances, Congress appropriated \$15,000 for the express purpose of giving a thorough test to the Serrell automatic reeling machinery, in the hope that by its means the question of labor might be minimized and we could reel silk at a profit. The previous attempts of the Department, which it had been my lot to direct, to establish such reeling or market centers at San Francisco, New Orleans, and Philadelphia had proved unsuccessful, and the promise was made to Congress that two years of experimentation under my immediate direction at Washington would permit a definite decision of the question. Two years passed, and the appropriation was increased and continued a third year for various reasons stated at the time. At the end of the third year I became convinced of the futility of continuing the experiments indicated without protective duty, and so stated in my report. While in Europe, in 1889, I paid particular attention to the question, and visited the Serrell works at the Serrell establishment at Chabeuil, where I found that Mr. Serrell had abandoned his own reeling machinery, which was stored in the cellar, and had gone back to the use of the ordinary non-automatic reeling machines, though employing improved automatic brushers and cleaners of his own invention, which have such advantages that they are fast coming into use in France and Italy. I felt more convinced than ever of the futility of continuing the experiments at Washington, except with the protection indicated, especially as any improvement or valuable outcome of such experiments would redound primarily to the advantage of a private corporation, and doubtless benefit other countries more than our own. The hope of improvement and the attractiveness of the machinery to the average visitor, among other reasons to which I need not now refer, have caused continuation of the special reeling work against my advice. From the

foregoing you will naturally draw the conclusion that I do not at present favor any time being wasted on the subject at the State stations, since Congress declined to put a duty on "raw" silk—a striking illustration of the inconsistencies of the tariff schedule.

LEGISLATION.

The amount of legislation in different countries that has of late years been deemed necessary or sufficiently important, in view of injurious insects, is a striking evidence of the increased attention paid to applied entomology; and while modern legislation of this kind has been, on the whole, far more intelligent than similar efforts in years gone by, many of the laws passed have nevertheless been unwise, futile, and impracticable, and even unnecessarily oppressive to other interests. The chief danger here is the intervention of politics or political methods. Expert counsel should guide our legislators and the steps taken should be thorough in order to be effective. We have had of late years in Germany very good evidence of the excellent results flowing from thorough methods, and the recent legislation in Massachusetts against the gipsy moth (*Ocnieria dispar*), which at one time threatened to become farcical, has, fortunately, proved more than usually successful, the commission appointed to deal with the subject having worked with energy and followed competent advice.

PUBLICATION.

On the question of publication of the results of our labors it is perhaps premature to dwell at length. Each of the experiment stations is publishing its own bulletins and reports quite independently of the others, but after a uniform plan, recommended by the Association with which we meet here, and with few exceptions that have come to my notice, another important recommendation of the same Association—that these publications shall be void of all personal matter—has been kept in mind. The office of Experiment Stations at Washington is doing what it can with the means at command to further the general work by issuing the Experiment Station Record, devoted chiefly to digests of the State station bulletins. There is a serious question in my mind as to the utility of State digests by the national department of results already published extensively by the different States, and distributed, under Government frank, to all similar institutions and to whomsoever is interested enough to ask for them. Such digests may or may not be intelligently made, and, even under the most favorable circumstances, will hardly serve any other purpose than as references to the original articles, and this could undoubtedly be done more satisfactorily to the stations and to the people at large by general and classified indexes to all the State documents, made as full as possible and issued at stated intervals. Only a small proportion of the bulletins

have been so far noticed by digest in this record, with no particular rule, so far as I can see, in the selection. This is perhaps inevitable under present arrangements. Complete and satisfactory digests of all, if intelligent and critical, imply a far greater force than is at present at Professor Atwater's command, and it is doubtful whether, even with increased facilities, they could be satisfactorily made without the assistance of the different specialists.

Under these circumstances it would seem wiser to devote all the energies of the Bureau to digests of the similar literature of other countries, which would be of immense advantage to our people and to the different station workers. Judging from the recommendations and resolutions of the general association this is the view very generally held, but except in chemistry and special industries, like that of beet sugar, very little of that kind of work has yet been attempted.

What is true of the station publications in general is equally true of special publications. As Entomologist of the Department I have been urged to bring together, at stated intervals, digests of the entomological publications of the different stations. Such digests, to be of any value, however, should also be critical; but it is at best a thankless task for any one to be critic or censor even of that which needs correction or criticism, and also difficult to maintain the judicial and impersonal attitude which should characterize official expression, in face of the severe criticism that some publications provoke. Moreover, to do this work intelligently would require the increase of the Divisional force, which at present is more advantageously employed; for, as already intimated, I should have grave doubts of the utility of such digests.

I believe, however, that the Division should strive for such increase of means as would justify the periodic publication, either independently or as a part of the Department record, of general and classified indexes to the entomological matter of the station bulletins, and should work more and more toward giving results from other parts of the world. This could perhaps best be done by titles of subject and of author so spaced and printed on stout paper that they could be cut and used in the ordinary card catalogue. The recipient could cut and systematically place the titles as fast as received.

As to the character of the matter of the entomological bulletins, it will inevitably be influenced by the needs and demands of the people of the respective States, and while originality should be kept in mind, there must needs be in the earlier years of the work much re-statement of what is already well known. That some results have been published of work which reflects no particular credit upon our calling is a mere incident of the new positions created. Yet we may expect marked improvement from year to year in this direction, and without being invidious, I would cite those of Professor Gillette on his spraying experiments and on the Plum Curculio and Plum Gouger, as models of what such bulletins should be.

Although the resolution offered at our last meeting by Professor Cook, to the effect that purely descriptive matter should be excluded from the station bulletins, met with no favor, but was laid on the table by the general association, I am in full sympathy with this position and am strongly of the opinion that in the ordinary bulletins such purely technical and descriptive matter should be reduced to the necessary minimum, consistent with clearness of statement and accuracy, and that if it is desired on the part of the station entomologists to issue technical and descriptive papers, a separate series of bulletins were better instituted for this class of matter.

Finally, for results which it is desired to get promptly before the people, the agricultural press is at our disposal, and so far as the entomological work of the Department of Agriculture is concerned, the periodical bulletin, *INSECT LIFE*, was established for this purpose. Its columns are open to all station workers, and I would here appeal to the members of the Association to help make it, as far as possible, national, by sending brief notes and digests of their work as it progresses. Hitherto we have been unable to make as much effort in this direction as we desired, but in future it is our hope to make the bulletin, as far as circumstances will permit, a national medium through which the results of work done in all parts of the country may quickly be put on record and distributed not only to all parts of our own country, but to all parts of the world.

The rapid growth and development of the national Department and the multiplication of its Divisions have necessitated special modes of publication and rendered the annual report almost an anachronism, so far as it pretends to be what it at one time was—a pretty complete report of the scientific and other work of the Department. The attempts which I have made through the proper authorities to get Congress to order quarto volumes similar to those issued by other Departments of the Government, for well illustrated scientific memoirs or monographs have not met with encouragement, and in this direction many of the stations will, let us hope, be able to do better.

COÖPERATION.

Every other subject that might be considered on this occasion must be subordinate to the one great question of coöperation. With the large increase of actual workers in our favorite field, distributed all over the country, the necessity for some coöperation and coördination must be apparent to every one. Just how this should be brought about or in what direction we may work toward it, will be for this Association in its deliberations to decide. Nor will I venture to anticipate the deliberations and conclusions of the special committee appointed to take the matter into consideration, beyond the statement that there are many directions in which we can adopt plans for mutual benefit. Take, for instance, the introduction and dissemination of parasites. How much

greater will be the chance of success in any particular case if we have all the different station entomologists interested in some specific plan to be carried out in coöperation with the national Department, which ought to have better facilities for introducing specimens to foreign countries or to different sections of our own country than any of the State stations. Let us suppose that the fruit-growers of one section of the country, comprising several States in area, need the benefit in their warfare against any particularly injurious insect of such natural enemy or enemies as are known to help the fruit-growers of some other section.

There will certainly be much greater chances of success in the carrying out of any scheme of introduction, if all the workers in the one section may be called upon through some central or national body to help in the introduction and disposition of the desired material into the other section. Or take the case of the Boll Worm investigation, already alluded to. The chances of success would be much greater if the entomologists in all the States interested were to give some attention to such Lepidopterous larvæ as are found to be affected with contagious diseases and to follow out some specific plan of cultivating and transmitting them to the party or parties with whom the actual trials are entrusted. The argument applies with still greater force to any international efforts. I need hardly multiply instances. There is, it is true, nothing to prevent any individual station entomologist from requesting coöperation of the other stations; nor is there anything to prevent the national Department from doing likewise; but in all organization results are more apt to flow from the power to direct rather than from mere liberty to request or plead. The station entomologist may be engrossed in some line of research which he deems of more importance to the people of his State and may resent being called upon to divert his energies, and with no central or national power to decide upon plans of coöperation for the common weal, we are left to voluntary methods, mutually devised, and it is here that this Association can, it seems to me, most fully justify its organization. And this brings me to the question of

THE DEPARTMENT OF AGRICULTURE AND THE STATE STATIONS.

Immediately connected with the question of coöperation is the relation of the National Department of Agriculture and the State experiment stations. The relation, instead of being vital and authoritative, is in reality a subordinate one. Many persons interested in the advancement of agriculture foresaw the advantage of having experiment stations attached to the State agricultural colleges founded under the Morrill act of 1862; but I think that in the minds of most persons the establishment of these stations implied some such connection with the National Department as that outlined in an address on agricultural advancement in the United States, which I had the honor to deliver in

1879 before the National Agricultural Congress at Rochester, and in which the following language was used :

In the light of the past history of the German experiment stations and their work, or of that in our own State of Connecticut, the expediency of purchasing an experimental farm of large dimensions in the vicinity of Washington is very questionable. There can be no doubt, however, of the value of a good experiment station there, that shall have its branches in every State of the Union. The results to flow from such stations will not depend upon the number of acres at command, and it will be far wiser and more economical for the Commissioner to make each agricultural college that accepted the Government endowment auxiliary to the national bureau, so that the experimental farm that is now, or should be, connected with each of these institutions might be at its service and under the general management of the superintendent of the main station. There is reason to believe that the directors of these colleges would cheerfully have them constituted as experiment stations under the direction of the Department, and thus help to make it really national—the head of a vast system that should ramify through all parts of the land. * * *

With the different State agricultural colleges and the State agricultural societies, or boards, we have every advantage for building up a National Bureau of Agriculture worthy of the country and its vast productive interests, and on a thoroughly economical basis, such as that of Prussia for instance.

In short, the view in mind was something in the nature of that which has since been adopted by our neighbors of the North, where there is a central or national station or farm at Ottawa and substations or branch farms at Nappan, Nova Scotia, Brandon, Manitoba, Indian Head, Northwest Territories, and Agassiz, British Columbia, all under the able direction of Mr. William Saunders, one of our esteemed fellow-workers. It was my privilege to be a good deal with Mr. Saunders when he was in Europe studying the experience of other countries in this matter, and the policy finally adopted in Canada as a result of his labors is an eminently wise one, presenting none of the difficulties and dangers which beset our plan, whether as between State and nation or college and station.

Under the present laws, and with the vast influence which the Association of Agricultural Colleges and Experiment Stations will wield, both in Congress and in the different States, there is great danger of transposition in this agricultural body politic of those parts which in the animal body are denominated head and tail; and the old saw to the effect that “the dog wags the tail because the tail can not wag the dog” will find another application. So far as the law goes the national Department, which should hold a truly national position toward State agricultural institutions depending on Federal support, can do little except by suggestion, whether in the line of directing plans or in any way coördinating or controlling the work of the different stations throughout the country. The men who influenced and shaped the legislation which resulted in the Hatch bill were careful that the Department’s function should be to indicate, not to dictate; to advise and assist, not to govern or regulate. We have, therefore, to depend on such

relationships and such plans of coöperation as will appear advantageous to all concerned, and these can best be brought about through such associations as are now in convention here. Without such plans there is great danger of such waste of energy and means and duplication of results as will bring the work into popular disfavor and invite disintegration, for already there is a growing feeling that agricultural experiment is and will be subordinated to the ordinary college work in the disposition of the Federal appropriations.

What is true of the national Department as a whole in its connection with the State stations is true in a greater or less degree of the different Divisions of the Department in connection with the different specialists of the stations. With the multiplicity of workers in any given direction in the different States the necessity for national work lessens. A favorite scheme of mine in the past, for instance (and one I am glad to say fully indorsed by Professor Willits), was to endeavor to have a permanent agent located in every section of the country that was sufficiently distinctive in its agricultural resources and climate, or, as a yet further elaboration of the same plan, one in each of the more important agricultural States. The necessity for such State agents has been lessened, if not obviated, by the Hatch bill and the subsequent modifications looking to permanent appropriations to the State stations or colleges which give no central power at Washington. The question then arises: What function shall the national Department perform? Its influence and field for usefulness have been lessened rather than augmented in the lines of actual investigation in very many directions. Many a State is already far better equipped both as to valuable surrounding land, laboratory and library facilities, more liberal salaries and greater freedom from red tape, administrative routine and restrictions as to expenditures than we are at Washington; and I can not see how the Department's influence is to be augmented outside of those Federal functions which are executive, except as a directing agent and a useful servant. Just what that directing influence is to be is the question of the hour, not only in the broader but in the special sense.

The same question in a narrower sense had arisen in the case of the few States which employed State entomologists. In the event, for instance, of an outbreak of some injurious insect, or in the event of any particular economic entomological question within the limits of the State having such an officer, the United States entomologist would naturally feel that any effort on his part would be unnecessary or might even be looked upon as an interference. He would feel that there was always danger of mere duplication of observation or experiment except where appealed to for aid or coöperation. This is perhaps true only of insects which are local or sectional, and is rather a narrow view of the matter; but it is one brought home from experience, and is certainly to be considered in our future plans. The favor with which the museum work of the national Division was viewed by you at the meeting last

November and the amount of material sent on for determination would indicate that the building up of a grand national reference collection will be most useful to the station workers; but to do this satisfactorily we need your coöperation, and I appeal to all entomologists to aid in this effort by sending duplicates of their types to Washington, and thus more fully insuring against ultimate loss thereof.

STATUS OF OUR SOCIETY.

This train of thought brings up the question of the status of our society with the station entomologists as represented by the committee of the general Association. Those of us who had desired a national association for the various purposes for which such associations are formed felt, I believe, if I may speak for them, that the creation of the different experiment stations rendered such an organization feasible. Your organization at Toronto and the constitution adopted and amended at the meeting at Washington all indicate that the chief object was the advancement of our chosen work and that the strength of the association would come from the experiment station entomologists. There was then no other organization of the kind, nor any intimation that such an one would be founded. Some of us, therefore, were surprised to learn from the circular sent out by Professor Forbes, its chairman, that the committee appointed by the Association of Agricultural Colleges and Experiment Stations, and through which we had hoped to communicate and coöperate with that Association, was not in the proper sense a committee, but a section which has prepared (and in fact was required by the executive committee and the rules of the superior body to prepare) a program of papers and discussions for the meeting to be held at the same time and place with our own. I can not but feel that this is, in some respects, a misfortune, and it will devolve upon you, as a consequence, to decide upon several questions of importance that will materially affect our future existence.

That there is not room for two national organizations having the same objects in view and meeting at the same time and place goes, I think, without saying; and if the committee of the general Association is to be anything more than a committee in the proper sense of the word, or if it is to assume, with or without formal constitution, the functions of our own Association, then our own must necessarily be crippled, and to do any good at all must meet at a different time and a different place. A committee or section, or whatever it may be called, of the general Association with which we meet would preclude active membership of any but those who come within the constitution of that body. Our Canadian friends, and many others who have identified themselves with applied entomology and do not belong to any of our State or Government institutions, would be debarred from active representation, however liberal the Association may have been in inviting such to participate, without power to vote, in its deliberations. Our own Associa-

tion has, or should have, no such limitations. Some of us who are entitled to membership in both bodies may feel indifferent as to the course finally decided upon, and that it will not make any difference whether we have an outside and independent organization as that of the Association of Official Chemists, or whether we do, as did the botanists and horticulturists, waive independence in favor of more direct connection with the general Association, providing there is some way whereby the committees of the general Association are given sufficient latitude and time to properly present their papers and deliberate; but there are others who feel more sensitive as to their action and are more immediately influenced by the feelings of the main body. I hope that whatever action be taken at this meeting the general good and the promotion of economic entomology will be kept in mind and that no sectional or personal feeling will be allowed to influence our deliberations.

SUGGESTION AND COMMENT.

You will, I know, pardon me if before concluding these remarks I venture to make a few comments which, though not altogether agreeable, are made in all sincerity and in the hope of doing good. The question as to how far purely technical and especially descriptive and monographic work should be done by the different stations or by the national Department is one which I have already alluded to and upon which we shall probably hold differing opinions and which will be settled according to the views of the authorities at the different stations. Individually I have ever felt that one ostensibly engaged in applied entomology and paid by the State or national Government to the end that he may benefit the agricultural community can be true to his trust only by largely overcoming the pleasure of purely entomological work having no practical bearing. I would, therefore, draw the line at descriptive work except where it is incidental to the economic work and for the purpose of giving accuracy to the popular and economic statements. This would make our work essentially biological, for all biologic investigation would be justified, not only because the life-habits of any insect, once ascertained, throw light on those of species which are closely related to it, but because we can never know when a species, at present harmless, may subsequently prove harmful and have to be classed among the species injurious to agriculture.

On the question of credit to their original sources of results already on record it is hardly necessary for me to advise, because good sense and the consensus of opinion will in the end justify or condemn a writer according as he prove just and conscientious in this regard.

There is one principle that should guide every careful writer, viz., that in any publications whatever where facts or opinions are put forth it should always be made clear as to which are based upon the author's personal experience and which are compiled or stated upon the authority of others. We should have no patience with a very common tendency

to set forth facts, even those relating to the most common and best known species, without the indications to which I have referred. The tendency belittles our calling and is generally misleading and confusing, especially for bibliographic work, and can not be too strongly deprecated.

On this point there will hardly be any difference of opinion; but I will allude to another question of credit upon which there prevails a good deal of loose opinion and custom. It is the habit of using illustrations of other authors without any indication of their original source. This is an equally vicious custom and one to be condemned, though I know that some have fallen into the habit without appreciation of its evil effect. It is, in my judgment, almost as blameworthy as to use the language or the facts of another without citing the authority. Every member of this Association who has due appreciation of the time and labor and special knowledge required to produce a good and true illustration of the transformations and chief characteristics of an insect will appreciate this criticism. However pardonable in fugitive newspaper articles in respect of cuts which, from repeated use, have become common, or which have no individuality, the habit inevitably gives a certain spurious character to more serious and official publications; for assumption of originality, whether intended or not, goes with uncredited matter, whether of text or figure. Nor is mere acknowledgment of loan or purchase, to the publisher, institution, or individual who may own the block or stone what I refer to; but that acknowledgement to the author of the figure or to the work in which it first appears which is part of conscientious writing, and often a valuable index as to the reliability of the figure.

It were supererogation to point out to a body of this kind the value of the most careful and thorough work in connection with life-histories and habits often involving, as it does, much microscopic study of structure. The officers of our institutions who control the funds, and more or less fully our conduct, are apt to be somewhat impatient and inappreciative of the time given to anatomic work, and where it is given for the purpose of describing species and of synopsis or monographing higher groups, without reference to agriculture, I am firmly of the belief that it diverts one from economic work; but where pursued for a definite economic purpose it can not be too careful or too thorough, and I know of no instances better calculated to appeal to and modify the views of those inclined to belittle such structural study than *Phylloxera* and *Icerya*. On the careful comparison of the European and American specimens of *Phylloxera vastatrix*, involving the most minute structures and details, depended originally those important economic questions which have resulted in legislation by many different nations and the regeneration of the affected vineyards of Europe, of our own Pacific coast, and of other parts of the world by the use of American resistant stocks. In the case of *Icerya purchasi* the possibilities of success in checking it by its

natural enemies from Australia hung at one time upon a question of specific difference between it and the *Icerya sacchari* of Signoret—a question of minute structure which the descriptions left unsettled and which could only be settled by the most careful structural study and the comparison of the types, involving a trip to Europe.

CONCLUSION.

I have thus touched, gentlemen, upon a few of the many subjects that crowd upon the mind for consideration on an occasion like this—a few gleanings from a field which is passing rich in promise and possibility. It is a field that some of us have cultivated for many years and yet have only scratched the surface; and if I have ventured to suggest or admonish, it is with the feeling that my own labors in this field are ere long about to end, and that I may not have another occasion. At no time in the history of the world has there, I trow, been gathered together such a body of devoted and capable workers in applied entomology. It marks an era in our calling, and looking back at the progress of the past fifteen years, we may well ponder the possibilities of the next fifteen. They will be fruitful of grand results in proportion as we persistently and combinedly pursue the yet unsolved problems, and are not tempted to the immediate presentation of separate facts which are so innumerable and so easily observed that their very wealth becomes an element of weakness. Epoch-making discoveries result only from this power of following up unswervingly any given problem or any fixed ideal. The kerosene emulsion, the cyclone nozzle, the history of *Phylloxera vastatrix*, of *Phorodon humuli*, of *Vedalia cardinalis*, are illustrations in point; and while we may not expect frequent results as striking or of as wide application as these, there is no end of important problems yet to be solved, and from the solution of which we may look for similar beneficial results. Applied entomology is often considered a sordid pursuit, but it only becomes so when the object is sordid. When pursued with unselfish enthusiasm born of the love of investigation and the delight in benefiting our fellow men it is inspiring, and there are few pursuits more deservedly so, considering the vast losses to our farmers from insect injury and the pressing need that the distressed husbandman has for every aid that can be given him. Our work is elevating in its sympathies for the struggles and suffering of others. Our standard should be high—the pursuit of knowledge for the advancement of agriculture. No official entomologist should lower it by sordid aims.

During the recent political campaign the farmer must have been sorely puzzled to know whether his interests needed protection or not. On the abstract question of tariff protection to his products we, as entomologists, may no more agree than do the politicians, or than does the farmer himself; but ours is a case of protection from injurious insects and upon that there can nowhere be division of opinion. It is

our duty to see that he gets it with as little tax for the means as possible.

Gentlemen, I thank you.

In the discussion which followed this address Mr. Cook expressed his hearty concurrence in the general tendency of the recommendations made. He had been especially interested in the subject of coöperation among workers. He considers that there is a great field for this in the indexing of the entomological writings of the country, so that it would be easy to find what had been done. In reference to the status of members in the Association of Agricultural Colleges and Experiment Stations, he supposed that Canadian members would have the same rights in committees of the association that others had when they occupied similar official positions.

Mr. Smith agreed as to the desirability of some scheme for indexing literature; but as to coöperation in other lines of work he thinks the time has not yet come. There is too much work coming on year after year which must be at once attended to. It was impossible to do very much planning ahead under present circumstances. His plans for the year had been almost entirely upset by unexpected invasions of insect pests, which he was compelled to study and report upon. The prime necessity is to supply our constituency with that information which they demand; and until almost all of the more common forms are treated we can not so command our time as to engage in any coöperative work requiring close or continuous observation and study.

Mr. James Fletcher, Dominion entomologist of Canada, spoke in high terms of the excellence of the presidential address. He said:

"You have drawn our attention to the fact, Mr. President, that this is the most remarkable meeting of economic entomologists which has ever met together, and I feel sure, sir, that every one present will agree with me that your address is one of the most remarkable we have ever had the privilege of listening to. You have covered so much ground and spoken upon so many subjects upon which we know you to be the highest authority, not only from the exceptional advantages you possess from your official position, but also from the experience you have gained from earnest and close attention for a quarter of a century to this special subject which we have gathered together to-day to discuss, that if we heard nothing else we should be well repaid for the trouble of attending this meeting. This great knowledge makes you *facile princeps* the most eminent living economic entomologist—a title to which, on account of the work you have done in developing the science of practical entomology, no one will dispute your claim. The present meeting, being a joint one of the Association of Economic Entomologists and of the Entomological Committee of the United States Experiment Stations, leads me to make these remarks, because probably the question which is most engaging the attention of many of us at the present time is whether any good purpose will be served by maintaining both of these organizations.

"We know that the committee of the experiment stations must meet, if the directors of stations order it; but I feel confident that the necessarily limited number of entomologists in that committee, even if every station eventually employs such an officer, cannot do such good work for the science and give them equal opportunities with those offered by an organization of the nature of the Association of Economic Entomologists, which will include many eminent men who are excluded from active membership by the rules of the committee. I refer to such men as Professor Riley and his assistants, Dr. Packard, Mr. French, Dr. Lintner, and hosts of other economic entomologists in the United States, as well as the Canadian entomologists, and many others who would be pleased to join in various parts of the world. I submit to the meeting that there is room for good work from both of these organizations, and that it would be extremely ill-advised to let either of them drop to the ground, for each should be of the greatest assistance to the other. I believe, too, that to no one can the association be of more use than to the experiment station entomologists; and therefore they should make every effort to sustain an association at the meeting of which they must always have greater freedom than they can have in the committee, where the proceedings will always be subject to a certain degree of restraint, both as to the time allowed for discussion and the subjects brought forward. The entomological committee is specially a meeting of the entomologists of the experiment stations, and any one else will always to a certain extent feel himself an outsider, no matter how cordially the hand of friendship may be extended to him. The president has stated that he does not care where the work is done so that it is carried on vigorously. This is probably the case, and the gentlemen I have mentioned have very little to learn from the meeting compared with the advantages which will accrue to us from having such men present at the meetings. I cannot help thinking that we shall make a serious mistake if we allow an organization to drop which will insure us their sympathy, attendance, and services, and will at the same time form a bond of union between the economic entomologists of the whole world."

Mr. Smith thought it an absurdity that there should be two bodies composed of nearly the same members, meeting on the same days, at the same place, and covering the same ground. He strongly advocated an effort to gain in the committee of the main association all those advantages that the present association offered, and suggested that this would be of advantage to station workers at least, as it gave them a recognized place in the official body of agricultural colleges and experiment stations.

Mr. Weed thought the status of some of the men had been misunderstood. The Canadian station was represented in the main body, and its various officers have the same rights and standing in committees as have those of the other stations. The Department of Agriculture is equally represented both in the main body and in the committees.

Mr. Cook then read the following paper:

WORK OF THE ENTOMOLOGISTS IN THE EXPERIMENT STATIONS.

By A. J. COOK.

The Congressional act creating the experiment stations and appropriating money for their support was an extraordinary measure, and should be, in its results, of exceeding importance to the agriculture of the country. Never before in the history of the world has action been taken that promised so much in the direction of the advance and quickening of scientific research, especially research in the line of applied science. Never before was there legislation that seemed to offer so much to promote the interests of our leading industrial pursuit. Indeed, the chief danger and peril of this new scheme arises from the fact of its extraordinary character and the large work which it contemplates. Great institutions, like great reforms, develop slowly. A mushroom growth of such enterprises is contrary to nature's methods, and is to be feared. If we attempt to produce such a growth, caution should be our watchword at every step.

There are four special dangers I think that confront our experiment stations: First, the danger of neglecting the practical in our work, or of making our work so technical that it will fail to interest or benefit the practical man. President Mendenhall, in his admirable address at Indianapolis last August, argued that this is a somewhat common fault with scientists, and is greatly to be regretted. How much more the fault, and how much more serious in its results, if we the scientists of the stations err in this direction. Secondly, the people, knowing of the large appropriations, will expect a great deal in the way of results, if the fruits are not soon forthcoming, and quite generous, criticism will likely follow. Such criticisms will do harm if they do not place the whole scheme in jeopardy. Again the very fear of the above may lead to hasty work—attempts at too much—so we shall be unable to do good work. This will lead to more just criticism, and may endanger the law and call for its repeal. The fourth danger is one common to all government work—the misappropriation of funds. From the very nature of the work, its magnitude and associations, this danger is not small, and its magnitude should make us all exceedingly cautious.

As entomologists of the stations we are in part responsible for the reputation of this measure. Our work will tend to make the law popular or bring it into disrepute; as we work faithfully and wisely or as we work carelessly or in directions not contemplated by those who framed the act. As we all well know, entomology has a wide practical side, and may and should give substantial aid in every station. We may do much to give the experiment stations character, and make the law establishing them popular.

I believe we should consider well how we may best promote the inter-

ests of the stations and the reputation of the whole scheme. It is with the desire to call forth discussion to this end, rather than any expectation of adding any valuable or new suggestions, that I prepare this paper.

NEW OR STRANGE INSECTS.

It occurs to me that one of the most important duties that will devolve upon us is to keep ourselves and the farmers informed in relation to new insect pests. Every year will doubtless bring insects new to our localities if not to the country. A few years ago *Agrotis fennica*, until then a very rare insect in all sections of our country, appeared in various parts of Michigan in overwhelming numbers. Its ravages were something alarming, and the people were in despair. By advising in such cases, explaining the habits and natural history of the insects, and informing as to the probabilities, which we are usually able to do, we allay fear, restore quiet, and make new and strong friends for the stations. We may also work out the life history of the insect, experiment regarding its destruction, and so do works that will benefit other States as well as our own. The present season several injurious insects have, for the first time, attracted attention in Michigan by their ravages, which in some cases, as with the linden span worm, *Hybernia tiliaria*, were very serious. These insects attacked the apple, elm, and basswood in devastating numbers. It was easy to suggest a remedy, and the people appreciate such information most heartily as it oftens means bread and butter to them. Every State needs and should have an adviser of this kind. The practical results are patent and immediate. I believe that such work will tell as strongly towards making the stations popular as any that may be attempted.

STUDYING LIFE HISTORIES.

This is scientific as well as practical work, and is so important that no word of commendation is necessary. A full description if presented in a non-technical style will interest the general reader as well as benefit science. Thus our best work will be constantly educating our readers, making them more and more competent to study, observe, and conquer the insect pests. We see that this best work that will fall to our hands will bring a triple blessing. It will develop science, show us how to overcome the enemies—for to know an insect's full life history and affinities is often the major part in its destruction if it is an enemy—and will interest and instruct the public as nothing else can.

A bulletin discussing a species that threatens some important crop will be read and reread. Men will always thoroughly study that which touches their pocket books. Thus, if carefully done, we can weave much of science into our reports which will not only be palatable, but eagerly sought after. We issued large editions of my bulletins on the grain

louse and its enemies. Yet they were all called for, and awakened strong interest in the subject, especially in the part relating to beneficial insects, as I know from the many letters received, asking for further information.

I believe no station can do more to arouse interest and incite to valuable study to give real valuable results to the people, and so to make friends, than to engage vigorously in this important work. We can hardly appreciate the value of this kind of work done by Dr. Riley, our president. This generation will never appreciate the debt of gratitude which they owe him. I believe that this part of our duties, carefully studying the life histories of all our insects, will take no second place in importance. How much we owe to Dr. Harris and to Thomas Say, for the admirable work they did in this direction. With the numerous workers now in the field, we ought to make great progress in this direction. Such work will not be ephemeral in its influence, but will keep on blessing mankind in all the coming years.

DIRECT EXPERIMENTATION.

In the discovery of new insecticides, and new uses of old ones, and of new and better methods of application of such substances, we have a simple means of conferring, it may be, an exceeding benefit upon the farming population. So numerous are our insect foes, and so different are their susceptibilities to various insecticides that very extensive and careful experimentation is called for in this direction. The arsenites, so fatal to most mandibulate insects, seem impotent as weapons against the rose chafer or the flea beetles. Tobacco decoction, though it fails to exterminate most beetles, is our best specific against the destructive flea beetles. Successful work in this direction may and surely will bring great aid to the farmers and fruit growers, and can but be thoroughly appreciated.

Thousands of experiments are needed for each insecticide now known and yet to be discovered, for each must be used on every noxious insect. To many this will seem an uninviting field, and yet I can not but think that he who fails to put earnest thought and work into this department of our duties will miss a rich opportunity to do just what the law contemplates, to confer much practical benefit on the farmers, and to advance the popularity of his station, and so of the whole scheme. Such experiments have given us remedies that are of immense benefit. We can not believe but that such discoveries are yet to be made; far more and very likely far better than we yet have. This then is a very desirable line of work which gives full opportunity for us all. We can also improve or suggest improvements in our apparatus for applying insecticides. We must have simple spraying apparatus that shall be convenient and durable. If we could arrange to have gravity do our pumping, how much labor and expense might be saved.

GENERALIZATIONS.

As scientists constantly in the field, we surely ought to be able to arrive at some valuable conclusions or to formulate laws that others could not discover. Such generalizations may be of great practical value. Last winter was exceptionally warm throughout our Northern States. The succeeding spring and summer were remarkable for the numbers of cutworms—larvæ of species of *Agrotis* and *Hadena*—and slugs, or larvæ of sawflies. If there is the relation of cause and effect between these two facts—mild winter and prosperity of such insects as pupate in the earth—further observation will prove it. If this is true, a knowledge of the fact would be very valuable, as a mild winter would warn farmers and fruit-growers of these terrible foes, and protective measures would be in readiness to check the evil at the onset.

THE WORK MUST BE PRACTICAL.

To many, purely scientific work will be more inviting than work looking towards practical results. The entomologist will note the great field, and his limited time, and may plan to work only in physiological, anatomical, or systematic entomology, arguing that such work in the end will do more for science, reputation, and possibly for the arts, than experiments in applied entomology. Is there not great danger here? Did not the act which established the stations contemplate that all our work should look towards economy or economic ends? If any of us ignore the practical, do we not run the risk of injuring our own influence and usefulness, and also of placing the whole grand scheme in peril? Akin to this danger, is the one of making our reports too technical. While it is desirable to incorporate all the science that can be made palatable, we should be very cautious not to go too far, lest we send out reports that shall not be read or understood. Then our work goes for naught, and we are subject to very severe and very just criticism. Dr. Harris and the late B. D. Walsh made real science appetizing to all. Happy for our stations if we are able to copy them in this respect.

OUR BULLETINS.

Just what our bulletins should contain is a matter of greatest importance, and worthy of exhaustive discussion at this meeting. There is something inspiring in the thought that we can gain the attention of thousands several times each year. How careful must we be that we win and keep the public ear; and that we do our readers good. These bulletins will, for the most part, be read and laid aside. Should not the main thought then be immediate good; must we confine ourselves to presenting only new matters, or only to the results of our experiments? Will it not be better to study the needs and condition of our readers, and then give them just what we believe will do them the most good, even if we send out information that is old, providing we know

that it will be new and valuable to the majority of our readers? We have experimented with new methods to protect our plums from the curculio. In publishing the results we act under the knowledge that many, perhaps most, who will read our bulletins do not know or practice the best methods to defend against this pest, though long and well known to the few. Should we not briefly but plainly explain these methods?

At our station there is a sort of a partnership between the State and the United States Government. The Government pays for the work and franks the bulletins, while the State pays for printing them. Thus I am free to say that in writing every bulletin, I keep in mind as the leading thought, what will do our people the most good? This question settled, and I send out the consequent information, even though some of the facts were known and taught by Aristotle. If I am wrong, I will gladly accept criticism.

MUTUAL AID AND SUGGESTIONS.

In closing, let me say that it seems to me that such meetings each year as this one will do much to exalt our work and influence. Kindly suggestion and criticism, and a full discussion of work and methods must lead to such harmony of action as will greatly augment the value of our work. Our yearly meetings will give freedom to our inquiries and consultations, which should be very free and helpful at all times. The ready help which we all get from the Division of Entomology of the Agricultural Department, at Washington, tells, in a magnified way, what we may each do for the other. Indeed many of our older workers have shown us repeatedly in the past how much we may receive, through suggestion and information from our brother workers.

Mr. Woodworth said that his station had been publishing just such material as Mr. Cook had mentioned, but he did not believe this was the real work of the stations. There should be lines of original research of general utility, and the results of these should appear in the bulletins. He thought that the newspapers should be utilized so far as possible to spread the information already known.

Mr. Harvey objected, that the farmers did not all take the same paper. They are constantly asking questions or calling for information on all kinds of insects, known as well as unknown. He does not think newspaper work the best in all cases.

Mr. Weed thinks this depends somewhat on the facilities possessed by the station. In Ohio they have what they call a newspaper bulletin sent to the manufacturers of "patent insides," through which they reach half the county papers in the State. The matter is sent out regularly by a central publishing house, and also in printed form to all the papers, by the States. These were also condensed into short paragraphs suitable for press dispatches, and thus obtained a wide circulation.

Mr. Webster thought there were two or three ways of getting at the public. A very good one is to publish the letter and reply in the local paper whence the letter is received. In that way it reaches the point where the information is most needed.

Mr. Smith thinks the best way to reach the farmer is to go and talk to him. Bulletins are not always read; but if you can meet the man personally at farmer's clubs, county board meetings, or institutes, you can interest him and tell him exactly what he wants to know. He can see the bearing of the recommendations made, and is more apt to follow the advice given in the bulletins. He believes in treating the farmers as intelligent men, capable of understanding the bearing of facts, and he does not hesitate to give them such anatomical or physiological facts as may be necessary to show the reasons for the recommendations made. He finds that in New Jersey at least they are able to follow him and appreciate argument. He believed in making a good many of the experiments on the farms of leading growers. By convincing these men the station obtained most powerful allies.

Mr. Cook suggests that our thought must be to do the people most good, whether this means the publication of old or new matter.

Mr. Harvey believes in issuing old matter in the most favorable form for use. In the reports and bulletins it would be permanent and could be referred to when needed.

Mr. Aldrich inquired whether the entomologist was usually charged with the practical work of keeping farm and garden free of insects. At his station they had been expected to take charge of the campaign.

Mr. Smith read the following:

FERTILIZERS AS INSECTICIDES.

By J. B. SMITH.

During the past season my attention was called to this subject by a farmer, who told me he cleared his pear trees of the scurfy scale by washing with water in which muriate of potash had been dissolved. He stated that this had been perfectly effective, and had entirely cleared the washed parts even when no scrubbing had been done. This led me to experiment a little with the potash salts, and to make inquiries of farmers who had used them in fertilizing quantities. I found the universal testimony to be that wherever potash was used on corn there was no trouble with cutworms or wireworms. Mr. E. B. Voorhees, the senior chemist of the station, is very positive on this point. He says that on his father's farm they were greatly troubled with cutworms and wireworms, especially on corn after sod; but since using the potash salts there is no further trouble on that score. Other testimony is to the same effect and is unanimous. In Salem County, N. J., in which I recommended kainit for peach-tree aphides, I was informed that young trees set in ground prepared with this substance grew well where pre-

viously they died off. I attribute this as much to the insecticide quality of the salts as to the fertilizing effect. I also learned from some farmers who used the potash that they were not troubled with the root louse, which in some parts of South Jersey is quite a serious pest.

My experiments were made to test the killing power of the substance. Kainit and muriate were dissolved in water at the rate of 1 ounce to 1 pint and sprayed on various species of aphides, against all of which it proved effective. It killed all the mealy bugs on greenhouse camellias without injury to the plants, and was effective against *Julus* sp., which were injuring potatoes. Larvæ of the cabbage maggot died when placed in soil moistened with the mixture, where those in a pure-water moistened soil were unaffected. Against hairy larvæ the applications were ineffective.

I tested it for injury to plants, and found the muriate somewhat injurious to tender leaves, where kainit did not affect them at all. The kainit, on the other hand, is slightly more effective against the insects. I would not recommend this against insects in general, but to reach underground species I think it will prove an effective remedy.

A number of growers have this year kept their cabbage clear of the larvæ of *Pieris rapæ* by using lime, either fresh, air-slaked, or in the form of a dry hydrate, first sifting it and then dusting on the plants when wet. Lime makes a good fertilizer, and almost every farmer has it. It is the simplest way we have of keeping this species in bounds.

The president stated that the use of fertilizers as insecticides was not new. Lime, salt, etc., had been used extensively abroad and in this country, while caustic soda and the potash salts were extensively used of late years against scale insects, especially in California. It is interesting to have a confirmation of older experience, and to draw attention once more to the subject by such valuable local trials as those enumerated by Mr. Smith.

Mr. Howard read a paper entitled :

THE HABITS OF PACHYNEURON.

By L. O. HOWARD.

[This paper is withheld for publication in No. 1, Vol. II of the Proceedings of the Entomological Society of Washington.]

In discussing this paper Mr. Harvey said that the gray birch in his locality was badly infested by a scale which seemed largely parasitized. He asked how these might best be bred.

Mr. Howard replied that these parasites were very easily reared. Their period of development is short and there are many broods in the course of the season. By confining a lot of the infested scales the parasites would soon make their appearance.

Mr. Woodworth asked how these parasites should be prepared or whether for purpose of identification they are best left unmounted.

Mr. Howard replied that they are best mounted on card points and preferably on the left side, at right angles to the point, the head forward and the dorsum outward (away from the pin).

Mr. Fletcher asked what would be the best mounting medium ?

Mr. Howard said that shellac is used at Washington.

Mr. Summers uses yellow shellac; he finds it more satisfactory than white.

Mr. Cook thought the white shellac excellent if of good quality. But it was not always good. He also finds Spalding's glue excellent.

Mr. Fletcher had seen some recommendation of shellac in naphtha had any one tried that ?

Mr. Smith then read the following :

NOTES ON THE PLUM CURCULIO.

By J. B. SMITH.

No attempts at such experimentations as have been made by Messrs. Cook, Weed, and Gillette have been undertaken, and only a single line of investigation, which suggested itself early in the season, was followed out.

First, I noticed a new food habit—new to me at least. In beating some bushes of the June or service berry (*Amelanchier canadensis*) I noticed the peculiar crescent marks of this plum curculio on the half-grown fruit. Closer search turned up also the beetles, so that there was no doubt as to the author of the punctures. The berries were very generally infested by a coleopterous larva which was not of this species and which I failed to bring to maturity. It is interesting that we should have this food plant for the species. The experiments were made with the view of determining to what extent the insects would come to maturity in apples. Early in the season, when the apples were all set and as large as a nut, a number of stung plums and apples were picked up beneath the trees and placed in jars on moist soil. From some of the most heavily loaded branches apples with several fresh punctures were picked and divided into two lots—one was placed on moist soil, the other in a dry jar, in which their position was frequently changed to prevent decay. Another lot of older apples with older punctures was placed on moist soil.

As a result, in the plums and apples picked from the ground nearly all the larvæ came to maturity; there was a larva for nearly every puncture. In one small apple there were nine mature larvæ. In the young apples picked from the branches and laid on moist soil the proportion of maturing larvæ was almost or quite as great. In those placed in the dry jars very few hatched and none came to maturity, as none of the apples rotted. In the older apples with old punctures, which were placed on moist soil, a few of the larvæ hatched and reached maturity.

During this period I had been examining apples remaining on the trees, and cutting down on the punctures. In only a few cases had any larvæ developed at all and in no case did any come to maturity.

The bearing of the investigation was, that if an orchard is kept clear of fallen fruit there would be no development of curculio on apple trees, since they require a decaying or fermenting mess to feed upon. Great stress should be placed on this point of picking fallen fruit, as it is fully as important as spraying.

Mr. Fletcher asked whether the curculio punctures did not cause the falling of the attacked apples.

Mr. Smith replied that they did not.

Mr. Beckwith said that in his experience the curculio is very abundant in apple orchards. He has noticed them flying out of the trees when spraying, on many occasions.

Mr. Harvey understood Mr. Smith to say that the plum curculio found in the fallen apples was the best condition for development, and for this reason he was pleased to have another argument for picking and destroying fallen fruit. It is the only way to get the better of the *Trypeta pomonella*, but he can not persuade farmers to go to the trouble. If there are two points to be gained, it may be easier to induce them to act. He thought that in his experience the punctured apple dropped early, but that very few larvæ matured. He had found many dead larvæ in punctured apples, and from one hundred only two beetles were reared.

Mr. Woodworth thinks that not all the larvæ in growing apples die.

Mr. Cook thinks that the development in growing apples is extremely rare. He remembers it as a great triumph when on one occasion he was able to show a living larva in a growing apple.

Dr. Goding stated that he had been unable to prepare a paper for the meeting as he had intended, and stated that he was at present collecting and studying Membracidæ. He asked all who might have material in this family to send to him for determination and study.

Mr. Smith read the following:

AN EXPERIENCE WITH THE ROSE BUG.

By J. B. SMITH.

It really was an experience. I had never seen insects in such numbers, in such constantly increasing swarms, and of such enormous industry. There was lots of fun in experimenting; but the fun was on the part of the rose bug, and not on the part of the experimenter. I spent a few days during the invasion at Vineland, and it was simply awful. Every cherry was cleared off, and many leaves were devoured. Apple trees presented a great mass of sprawling rose bugs burdening each apple. The fruit itself was not visible, but its situation was

marked by the clumps of beetles. Nothing escaped them except peaches, and they only escaped because there were none anyway! But even peach foliage was attacked. Pears were infested as badly as apples; but quinces were not such favorites. Of the small fruits, the blackberries seemed very attractive. They were on each blossom and ate the petals but left the green, forming fruit. Last year they ate the leaves as well and left only the canes. This year they left the leaves. Raspberries were totally destroyed. Last season they were in such force on Colonel Pearson's strawberry patches that the field looked a yellow mass of moving insects. Magnolias are immense favorites and the trees were loaded. Millions of them swarmed in a couple of sour-gum trees on the road. In the woods a number of trees and shrubs were defoliated, and sumach was neatly scraped, the upper surface only of the leaves being eaten. In Mrs. Treat's garden her flowers suffered greatly. Poppies were great favorites, while hollyhocks bore heavy burdens; not only flowers and buds were eaten, but masses of them ate even into the stem. The foxglove was also attacked; but this was fatal to those that ate, as a circle of dead beetles around each plant proved. The plant was not a favorite, however, and could never prove a protection.

Larkspur only seemed exempt, no beetles being seen on this and no plants were found injured. Roses are well known favorites, and blossoms and buds were completely devoured. In the vineyard the havoc was woeful. Dozens of them were on each bunch of blossoms and their fate was sealed. There were not enough blossoms to go around and the leaves were attacked. On Clintons they ate the entire substance of the leaf; on Concords they ate only the top, leaving the woolly underside. The destruction of the leaf was equally complete either way, for the shaved leaves dried and withered. Concord blossoms were rather the favorites, being in better condition for food than the Clintons, on which considerable fruit had set.

The contemplation of such enormous swarms induced a feeling of helplessness that was discouraging. Colonel Pearson has done considerable experimenting on his own account, and I accepted his experience as conclusive, knowing the Colonel's reliability on such matters. He had used the various copper compounds and found none of them effective. Vines completely coated with the Bordeaux mixture were just as badly attacked as were those where none was applied. London purple had been applied to some vines, and while it was effective so far as killing some of the insects is concerned, it was not protective at all, since all the buds and blossoms were eaten before the poison began to work. Here is our most serious problem. The insects come in immense swarms and come suddenly; they attack at once the very heart of the crop—*i. e.*, the blossoms—and do the injury long before the applied internal poisons can have any chance to prove effective. Then, even if the first column is overthrown and destroyed, new forces are

constantly arriving, and whatever is left by the first lot is sure to be found by the second or third or some other of the twenty or more armies that make their appearance day by day.

To try the effect of repellants I used carbolated lime on a row of vines, putting it on very thoroughly with a Leggett "gun." The stuff was certainly repugnant enough to all but rosebugs, and they did not mind it in the least. Fresh air-slacked lime dusted into the vines proved equally ineffective in other hands, and whitewashing, or what practically amounted to it, was equally bare of results in Colonel Pearson's experience. This was to be expected, where the Bordeaux mixture itself was eaten. Copper evidently added nothing to the lime, and neither did the carbolic acid. I had some hope of naphthalin, and dusted a row with the powdered substance, mixed with precipitated carbonate of lime in equal parts. The odor was plainly perceptible for 10 feet either side of the row, and yet the beetles minded it not in the least. They ate the leaves less, but to the buds and flowers the powder formed only an agreeable relish.

I tried it with tobacco with equally barren results. I put on the tobacco powder dry, and the insects seemed to take it greedily. X. O. dust was equally ineffective. Then I got up early in the morning and dusted a couple of rows while yet everything was wet with dew. The result was the same. Tobacco evidently agrees with this species and forms only an appetizer. But I tried it again. I made a decoction of 1 pound of ground tobacco to 1 gallon of water, using 2 quarts of boiling hot water and pouring through the tobacco and adding two quarts of cold water. Then I stirred in the dust itself and sprayed on a row of blackberries. I selected these because the beetles were very numerous and easy to reach. The leaves and blossoms were coated with the brown mixture, which soon became viscid by evaporation and ought to have been repugnant to all well regulated insects. But the rosebugs did not mind it in the least and seemed to feed with increased relish. Tobacco was evidently no good. Pyrethrum had been highly recommended, and I gave this also a good trial. I used it first at the rate of 1 ounce to 1 gallon on blackberry bushes. A few of the beetles dropped, kicked about for a few minutes until dry, and then flew back to the plants and resumed their feeding, apparently none the worse. I jumped from this to one-fourth pound to 1 gallon of water, using a fresh article both of the Persian powder and of the Buhach in two different experiments, stirring in the powder after extracting with boiling hot water. This promised well. A few minutes after the application the beetles were dropping from the plants in every direction, and in ten minutes scarcely a beetle was left on the bushes. They lay on the ground, struggling at first and then quiet and motionless. They were, however, still alive, and I waited patiently for their death. But they had not the slightest intention of obliging me, and at the end of half an hour began to recover from their stupor. From a feeble motion, as though

awakening after a sound nap, they rapidly recovered activity, and at the end of another fifteen minutes they were again back upon the flowers. These were coated with the yellow powder and this was readily eaten without any obvious bad effects.

This was discouraging; but one more test was made. Colonel Pearson had paid \$2 per pound for an article guaranteed fresh, pure, and more powerful than any other, and of this we used an ounce in 2 quarts of water, adding a cup of molasses to make it more sticky and lasting. This was sprayed on a rosebush near the house. It had rained during the night, the bush was in the shade, the insects were cold and sluggish, and all conditions were favorable. The insects showed the usual effect at once. Most of them dropped, and many hung on by their toenails only. The ground was wet and cold, and there they lay for hours, apparently dead. But I am always suspicious of a rosebug, and I gathered a handful and placed them in the sun. My suspicions proved well founded, and all these insects, as soon as they became warm and dry, recovered and flew away. This also happened, though more slowly, where the insects were not laid in the sun, but only removed to a dry place. Pyrethrum was a failure. But even were it not so the cost of protecting a vineyard with pyrethrum would be greater than the margin of profit on the grapes.

Quassia was tried in the form of a strong decoction, bitter as gall. But the rosebug has the organs of taste very imperfectly developed, and did not seem to object to quassia at all. It probably acted as a gentle stimulant.

Colonel Pearson thought he had noticed that acetate of copper was at least distasteful to them, and we stained a lot of white roses green by spraying with this substance. They were not quite so attractive as others that were left unsprayed, but were also eaten.

Digitalis was tried and proved ineffective. Acetic acid also failed. Colonel Pearson had used kerosene emulsion with the effect of driving them away temporarily; but they soon returned and it was not really effective.

I had about concluded that the only thing that rose bugs ever died of was nervous debility; for besides eating, their chief business in life seemed to be copulating, and this they attended to "with a persistence that was worthy a better cause." It made no difference that towards the end of their stay the females had not an egg remaining in the ovaries; this business suffered no abatement.

About the time when the period of their stay was near its end, we received from the Columbia Chemical Works, Brooklyn, N. Y., a sludge oil soap which Colonel Pearson reports successful in killing these insects. It needs further trial before being positively recommended. As to my other experiments with these insects, are they not written in my annual report? This will appear in time for the next invasion, and I need only add a few words concerning their breeding places. I find that these

occupy the whole of the sand district in South Jersey, and that the larvæ are in great abundance everywhere in the brush lands, even down to the shore. It is utterly impractical from this fact to take any measures to destroy the larvæ, since thousands of acres of uncultivated land are infested to a really startling extent!

Mr. Alwood said that he was also in the rose-bug region, but that he never met them in such numbers as were described by Mr. Smith. In his experience the kerosene emulsion would kill them readily, and he was able to keep them down by the use of arsenites. He stated that he was not fully satisfied as to methods of treating this insect, but fully expected to master it in the future.

Mr. Howard asked where the pyrethrum for these experiments was obtained.

Mr. Smith replied that he had been at special pains to get a fresh material in New York City, both of Buhach and of the Persian powder, and that Colonel Pearson, in his determination to get the best, paid \$2 for a pound of a guaranteed article in Philadelphia.

NOVEMBER 13—MORNING MEETING.

Twenty-one persons present, Dr. Riley in the chair.

The assessment imposed at the previous meeting was called for by the president, and \$4.25 was paid over to the Secretary to reimburse him for expenses incurred and to be incurred.

The election of officers for the next meeting was then taken up, and resulted as follows:

For President	James Fletcher.
For Vice President	F. H. Snow.
For Second Vice President	Herbert Osborn.
For Secretary	L. O. Howard.

On motion of Mr. Howard, the committee on coöperation was continued.

Mr. Smith stated that many of the bulletins of the stations did not reach him, and he asked rather than moved that each member of the association mail to each other member a copy of every bulletin so issued, and also that each member receiving such copy acknowledge receipt to the sender.

Mr. Forbes agreed to this proposition. It was not until he attempted to gain a review of the work of the year that he found how many bulletins he lacked.

Mr. Woodworth asked that each member of the association be furnished with a list of the members.

Mr. Howard asked that the members of the staff of the Entomological Division be included.

Mr. Forbes moved that the invitation of Entomological Club of the A. A. A. S., that this association meet with them next year at Washington be accepted.

Mr. Osborn explained that it was intended that the meeting of this association should be called a day or two before the meeting of the association, the exact day and time to be left to the committee.

Mr. Smith called attention to the fact that we were about to get into the same snarl we were in this year. The Association of Agricultural Colleges and Experiment Stations expected to meet at the same place and time, and we would then have three clubs of the same members all meeting at about the same time, two of them more or less in opposition. It seemed to him that one strong body was much the best.

Mr. Forbes stated that at last accounts the Association of Colleges and Stations had voted not to go to Washington. Mr. Smith there upon withdrew his objection, and the motion was carried.

Mr. Howard asked the present status of Mr. Lintner's amendment.

Mr. Smith moved that in view of the practical separation of this body from the official organization, Mr. Lintner's amendment be taken up and passed. The motion was carried, and section 1 of the constitution now reads as follows :

SEC. 1. This association shall be known as the Association of Economic Entomologists.

Mr. Summers asked how this affects the standing of members.

Mr. Smith read the provision of the constitution defining membership, and stated that the omission of the word "official" from the title changed the nature of the association so that there was no necessity for the distinction between official and nonofficial entomologists.

Mr. Summers moved that section 3 of the constitution be amended to read as follows :

SEC. 3. The membership shall be confined to workers in economic entomology. All economic entomologists employed by the general or State governments, or by the State experiment stations, or by any agricultural or horticultural association, and all teachers of economic entomology in educational institutes, may become members of the association by transmitting the proper credentials to the secretary, and by authorizing him to sign their names to this constitution. Other persons engaged in practical work in economic entomology may be elected by a two-thirds vote of the members present at any regular meeting of the association. Members residing out of the United States or Canada shall be designated foreign members. Foreign members shall not be entitled to hold office or to vote.

Under the law this amendment lies over until the next regular meeting.

Mr. Cook moved that a committee of three of the best men be appointed by the president to make arrangements for a program that would represent the entomologists before section F of the A. A. A. S.

Mr. Smith seconded the motion, and suggested that Mr. Cook designate the committee to relieve the president from the task of selecting the three best men. But he opposed the motion on the ground that our association had absolutely no standing in the A. A. A. S., while there did exist an entomological club of that association through whom, if at all, such an arrangement should be made. He thought the officers

of that club the proper persons to look out for the entomological interests at the A. A. A. S.

Mr. Osborn said that the club of the association was not a part of it by official connection, any more than this association was. It was recognized and provided for, but was not a part of it.

The president thought the purpose of the motion a good one, and hoped that in some way it would be carried out.

Mr. Smith stated that the club was a part of the association to this extent, that it was furnished badges and its proceedings had been published in the proceedings of the A. A. A. S.; it consisted primarily of members of the association, and that the matters to come before our body were not matters to go before the association anyway.

Mr. Osborn suggested that the committee to be appointed by the president be composed of members of the A. A. A. S.

Mr. Woodworth asked what the meaning of the proposition was; whether the matter to be presented was to be scientific or economic.

Mr. Webster said that last year the botanists had discussed the distribution of plants, and that a great deal of interest had been manifested in their meetings.

Mr. Cook had intended to leave the selection of the topic entirely to the members of the committee.

Mr. Forbes thought we should not present economic matters before section F.

Mr. Fletcher suggested that the committee be appointed to confer with the officers of the club or to suggest a programme.

Mr. Howard thought with Mr. Smith, that the whole matter was very much out of place here.

The motion was put and lost.

Mr. Smith read the following paper:

SOME QUESTIONS RELATING TO APHIDIDÆ.

By J. B. SMITH.

I have practically stated the points of my paper in the discussion of Mr. Weed's paper in the committee on entomology, and will therefore touch on the matter but very briefly.

I think more attention should be paid to the structure of the poriferous system of the antennæ in the separation of species. I have found this character invariable in the specimens examined, and believe it to be of great value for specific determination. A fact of some importance is also brought out in this examination, the poriferous system remains the same from birth to the pupa stage—and only when the winged individual appears does the typical or specific system appear. I think that this is important evidence as bearing on the question of whether the wingless viviparous females are larvæ or are really mature forms. I think that this is simply an arrest of development, and that it is a

true larval reproduction; that these forms are not in any sense mature insects. Finally, what function do these pits fulfill? I am not at all satisfied with any of the explanations thus far made.

Mr. Webster asked why it is that some young of the same female will obtain wings and others not, and why those females possessing wings were the least prolific.

Mr. Smith did not pretend to answer this question; the fact was known to him and had been frequently observed; the wingless, viviparous forms seemed for some reason to be interrupted in their development.

Mr. Osborn said that the poriferous system in the sexed individuals in species familiar to him is much more simple than in the winged viviparous forms; but he could not say that it was the same as in the larval forms.

Mr. Webster had observed that the wingless female is much more quiet and docile and not easily disturbed, while the winged female is wild and sometimes entirely unmanageable.

Mr. Gillette read a paper entitled:

NOTES ON THE PLUM CURCULIO AND PLUM GOUGER.

C. P. GILLETTE.

EGG-LAYING RECORD OF THE PLUM GOUGER.

On the 1st of June last a male and female gouger were taken in *copula* and placed under a bell jar in my study, where they were kept supplied with fresh plums. A complete daily record of the number of punctures made by these beetles, and also of the number of eggs deposited by the female, was kept. The first eggs were deposited during the night of June 2 and the last eggs were deposited on June 22, making the period of oviposition in this case twenty days.

In order to economize space I will give the record in periods of five days each, beginning on June 2. I will also give the whole number of punctures made by both beetles for food and oviposition in each period. First period, 366 punctures and 136 eggs; second period, 318 punctures and 136 eggs; third period, 321 punctures and 125 eggs; fourth period, 161 punctures and 51 eggs; fifth period, 96 punctures and 2 eggs; sixth period (three days), 4 punctures and no eggs. This makes a total of 1,266 punctures and 450 eggs, or about 2.8 punctures per egg. This makes no account of the large number of punctures made by the beetles for food in buds and blossoms before oviposition began. From the time egg-laying began there were no omissions of a single day to the time the last eggs were laid, on June 22. The largest number of eggs deposited in one day (twenty-four hours) is 49 for June 3. Up to June 20 the smallest number deposited in one day was 12, the number found

June 18. As the deposition of eggs is so rapid, especially at the first, it is very important that the beetles be checked in their operations as early as possible in the season.

The eggs were counted between 7 and 8 o'clock each morning and about 6 o'clock each evening. A few more eggs were laid during the night than during the day as thus divided. The beetles took no food after June 28 and died about July 12. Up to and including June 7 the beetles were seen pairing not less than fourteen times, but not once after that date.

EGG-LAYING RECORD OF A PLUM CURCULIO.

A single female curculio that was brought into the laboratory on June 7 and daily supplied with fresh plums made 426 punctures and deposited 167 eggs up to July 17. The largest number of eggs laid in twenty-four hours was 11. It is highly probable that this beetle had laid many eggs before being captured, but I give these figures because I believe no statements based upon an actual count has ever been made as to the number of eggs deposited by the curculio or the length of time covered by a single female in the period of oviposition.

LONDON PURPLE FOR THE DESTRUCTION OF THE CURCULIO AND GOUGER.

Ten minor plum trees standing in a row, and isolated from all other plum trees by about 60 rods, were used in an experiment to test the value of London purple for the destruction of the plum curculio and the plum gouger. Five trees at one end of the row were thoroughly treated with London purple in water in the following proportions and on the following dates: May 1, 1 pound to 200 gallons; May 10, 1 pound to 250 gallons; May 14, 1 pound to 300 gallons; May 26, 1 pound to 250 gallons; June 2, 1 pound to 256 gallons; June 7, 1 pound to 256 gallons. Trees 6, 7, and 8 were treated like the above, but with pure water that they might be proper checks. It was thought necessary to spray these trees with water for fear that the curculios and gougers, which are timid creatures, might be driven by the spraying from the treated trees to accumulate unduly upon the checks. Trees 9 and 10 were untreated. It rained very frequently during the period that the applications were made, and although a considerable burning of the leaves was apparent where the London purple was used, the injury to the foliage was not serious. All fallen fruit was gathered and examined, and the plums remaining on the trees were all examined before they were ripe. Forty-five per cent. of all the fruit of the trees treated with London purple was injured by the curculio, and 64 per cent. by the gouger.

The trees treated with water had 48 per cent. of their fruit injured by the curculio and 75 per cent. by the gouger. This shows a slight saving in favor of the London purple treatment. The two untreated trees

had 13 per cent. of their fruit injured by the curculio and 52 per cent. by the gouger, an injury far less, especially in case of the curculio, than in either of the previous lots. These last trees, however, were rather near the house, and were so located that they were frequently passed by persons going into the garden and probably were not good checks, but I can see no reason why the trees sprayed with water were not good checks for the trees treated with London purple. However this may be, the experiment shows that a large percentage of the fruit may be destroyed by the curculio and gouger upon trees thoroughly and repeatedly sprayed with London purple. It is also true that these trees were much worse attacked by curculio this year than they were last. In a large number of untreated native varieties in my experiments this year none were worse attacked than the above lot treated with London purple.

Mr. Bruner presented a paper entitled :

NOTES ON BEET INSECTS.

By LAWRENCE BRUNER.

[Author's abstract.]

Mr. Bruner gave a brief account of the insect enemies of the beet about as follows :

"Ever since the sugar beet question has been agitated in the West, and now particularly that a large factory for the manufacture of sugar from that plant has been built at Grand Island, in Nebraska, there is much interest taken in the subject. Every gathering of farmers or other tillers of the soil makes it a point to discuss the different features of the sugar-beet question. Even the subject of insect attacks upon the beet has received some attention from these gatherings.

"This last feature of the subject is by no means the least important of the matters connected with the culture of the beet for sugar. I have made a casual study of the insect enemies of the beet during the past summer and have reported in a preliminary way to Professor Riley as a part of my work under the Division of Entomology. My studies have resulted in finding at least sixty-four distinct species that feed upon that plant, either upon the leaves, or on the root. These are as follows:

<i>Spilosoma virginicæ.</i>	<i>Melanoplus femur-rubrum.</i>
<i>isabella.</i>	<i>atlanis.</i>
<i>Mamestra picta.</i>	<i>spretus.</i>
<i>chenopodii.</i>	<i>differentialis.</i>
<i>Eurycreon rantis.</i>	<i>bivittatus.</i>
<i>Plusia brassicæ.</i>	<i>Dissosteira carolina.</i>
<i>Deilephila lineata.</i>	<i>Trimerotropis latifasciata.</i>
<i>Copidryas gloveri.</i>	<i>Spharagemon æquale.</i>
<i>Agrotis</i> , several species.	<i>Pezotettix olivaceus.</i>
• <i>Leucania unipuncta.</i>	<i>Ligyris gibbosus.</i>
<i>Botis posticata.</i>	<i>Lachnosterna fusca</i> , and others.

Wire worms, several species.
 Unknown Coleopterous larva.
Silpha opaca.
Diabrotica 12-punctata.
Disonycha triangularis.
 cervicalis.
 xanthomaelena.
 crenicollis.
Systema frontalis.
 tæniata.
Psylliodes convexior.
Chaetocnema denticulata.
Epitrix cucumeris.
Epicauta pennsylvanica.
 sp.
 maculata.
 vittata.
Macrobasis *sp.*
Cantharis nuttalli.
Colaspis brunneus.
Epicaerus imbricatus.

Centrinus penicellus.
 perscitus.
Apion *sp.*
Doryphora 10-lineata.
Micropus leucopterus.
Piesma cinera.
Nysius angustatus.
Geocoris bullata.
Trapezonotus nebulosus.
Emblethis arenarius.
Lygus pratensis.
Euthoctha galeator.
Agallia siccifolia.
 sp.
Allygus *sp.*
Erythroneura *sp.*
 sp.
Liburnia intertexta.
Aphis atriplicis.
 cucumeris.
Siphonophora pisi.

“In the study of the beet insects it was found that the most common species that are usually known as ‘weed-feeding’ forms were the first to attack the beet. All these that attack the common garden as well as field weeds also attack the beet. These are such as feed upon the ‘pig-weed,’ the *Amarantus*, the purslane, ‘tumble-weed,’ etc.”

In closing, Mr. Bruner requested that all entomologists assist in the further study of these beet insects by sending him the names of, or any notes in relation to, such species as are not included in his list given above. He expects to continue the study the coming year with a view of publishing results in the form of a special bulletin from the Nebraska Agricultural Experiment Station.

Mr. Fletcher asked whether there was any practical remedy for the *Anthomyia* attacking beet-root leaves.

Mr. Howard asked whether *Silpha opaca* has been found feeding on beets in this country; it is a well known enemy to this crop in Europe.

Mr. Bruner did not know that this was so from personal observation.

Mr. Fletcher expressed interest in the habits of *Collops*. He had taken it by sweeping grasses.

Mr. Smith had found it commonly on golden rod.

Mr. Smith related the following:

AN INVASION BY THE CLOVER-LEAF BEETLE.

By J. B. SMITH.

This insect has not been heretofore known as a troublesome species in New Jersey. During the season of 1889 larvæ and pupæ were sent from the northern part of the State, and there was an abnormal increase all around the State. In Philadelphia, where most of the collectors had never taken it, it became suddenly the most common species. Everything pointed to an injurious invasion of the species, and such I predicted in my report for 1889. Early in the season of 1890 I received complaints of a caterpillar on clover in enormous numbers. Specimens sent, in response to my request, reached me in a defunct condition, evidently killed by a fungus disease. Meanwhile the same complaints were made in other parts of the State, and the newspapers reported them as being gathered by the bushel. I could not get hold of a living specimen, and all the reports stated that they crawled up to the tops of grass blades and coiled themselves up. In Gloucester County I finally found the larvæ myself, and after some search found also a few living specimens which I recognized as the larvæ of the clover-leaf beetle; but before I could get them home they were killed by the fungus, and some put in weak alcohol were discolored by the disease and distorted so as to be useless as specimens of the species.

Afterward I found the remains of these same larvæ in clover fields in all parts of the State visited by me, but nowhere a living larva. The specific effect of the disease caused by *Empusa sphærosperma* seems to be inducing the larva to crawl to the tops of grass blades and coiling themselves around the extreme tips or as near as they could get to it. What promised to be a terrible destructive attack was happily prevented by the effects of this disease, which almost completely exterminated the larvæ. There were two remarkable things: First, the enormous numbers in which the larvæ appeared all over the State where no beetles were observed last year—I did not find one near New Brunswick—and yet the larvæ were here in destructive numbers this spring; and second, the equally widespread disease, which was in all places at the same time.

That some larvæ escaped is proved by the fact that at Long Branch Beach I found the beetle very common in midsummer. Near Philadelphia, I am informed, the beetle has been very rarely seen this year.

Mr. Howard mentioned a similar attack in Lancaster County, Pa., and stated that Professor Riley had recently received a larva indistinguishable from this which had been found feeding on timothy.

Mr. Woodworth said that he had in Arkansas observed three epidemics among insects which seemed to stamp out the infested species almost entirely. On one occasion the tomato worm was utterly exterminated.

Mr. Fletcher asked whether *Phytonomus nigrirostris* had been observed as injurious to clover. He had often taken the larva feeding on clover in different parts of Canada, and in one instance, as recorded in his report for 1884, it was injuriously abundant in New Brunswick.

Mr. Smith replied that it is also not uncommon on clover in New Jersey, but did not do damage enough to attract attention.

Mr. Gillette said that he had found a small yellow caterpillar in considerable numbers on clover, feeding at the base of leaves, in September, at Ames, and asked whether any one else had noticed it.

Mr. Smith said that he had been experimenting for some time with preservative media, looking to some substance which should preserve greens, and general form better than alcohol. He had best success with acetic acid. The histological action of this is to swell the cell and nucleus, and insects preserved in this, extended limbs, antennæ, and mouth parts, and left them in excellent condition for examination. In some cases it distorted by extending insects preserved in it. It does not dissolve chlorophyll, but does not prevent bleaching to some extent at least. Reds do not do so well. Mixed with alcohol in equal parts it preserves form perfectly, and in general color also much better than alcohol alone. He has found this the most satisfactory medium thus far used.

Mr. Howard asked how long specimens had been so preserved and how many times the liquid had been changed.

Mr. Smith replied that he had none longer than six months, and that there had been no change of liquid. He found this especially useful for aphides, the form of which it preserved perfectly.

Mr. Woodworth gave as the best preservative process killing in water at 90° centigrade, leaving from one to five minutes. Then put into alcohol, 35 per cent. one to two hours, 50 per cent. from six to eight hours, 75 per cent. for twenty-four hours or more, and then to absolute alcohol. This would usually preserve perfectly, and was a recognized process for hardening and preserving for histological purposes.

Mr. Fletcher asked whether, in the case of large Sphingid larvæ, there should be any puncturing of the epidermis to facilitate penetration by the preservative media.

Mr. Woodworth replied that a certain amount of discretion and judgment must be exercised, but that puncturing was not often necessary.

Mr. Fletcher said that he had taken a lot of *S. chersis* larvæ on ash. They varied remarkably in color and maculation and were blotched and spotted in various ways. He had a fine series of about forty specimens, all different, but that all at the top of the jar were much discolored. They were all right at the bottom, but at the top they became black and discolored. He thinks that discoloration is frequently due to decay of the central portions of large larvæ.

Mr. Forbes said that they use the method described by Mr. Woodworth in the laboratory, and that they have some very fine specimens.

It does not preserve greens, but the browns are preserved and the markings are well brought out.

Mr. Marten said that hot alcohol is equally good for all but green larvæ, and that the boiling water is not a necessity. They have some very fine specimens preserved in this way.

Mr. Forbes read the following :

A SUMMARY HISTORY OF THE CORN-ROOT APHIS.

By S. A. FORBES.

The points of special interest in the history of the corn-root louse are the time and place of oviposition, the stage and place of hibernation, the relations of the root louse to the leaf louse of corn, the alternative food plants of each, and the relations of the root lice to ants. The account here given is based upon observations and experiments made by myself and my assistants at the office, beginning with the year 1882. The facts concerning oviposition were ascertained by simple observation of the oviparous female in the field and in the laboratory. The method of hibernation was ascertained by field observations late in fall and early in spring. The statements made concerning food plants other than corn depend in part upon collections of the corn-root louse made on various plants (the identity of the species being verified in each case by successful maintenance and propagation on corn), and in part by the incidental transfer of corn lice to other vegetation in our breeding cages.

The relations of the root lice to ants have been made out by very many and careful explorations of formicaries in the field, by watching the operations of ants among the lice, by laboratory experiments with artificial formicaries, and by various indoor experiments with ants deprived of lice, with lice deprived of ants, and the like.

The connection between root and aerial forms has been studied by means of field observations intended to trace the first origin of the latter in summer and their fate in autumn ; and especially by oft-repeated breeding experiments with corn inclosed under cloth covered frames. In our latest experiments of this sort, the cloth inclosures were very large, to prevent the possible introduction of the leaf louse by the females' producing young upon the cloth where the corn leaves touched it. The earth within these inclosures was thoroughly disinfected, and planted to corn in the spring, and colonies of ants were started here and kept continuously supplied with corn-root lice throughout the season, the object being to ascertain whether the evolution of the aerial louse would occur under these strict conditions. We have also repeatedly tried the direct transfer of root lice of various generations to the corn leaf, inclosed in a way to preclude outside interference.

The principal facts arrived at can be most conveniently given in the form of a biographical narrative extending through the year.

The root louse hibernates as an egg in the earth, and, as far as known, only in the nests of ants of a species identified for me by August Forel as *Lasius brunneus*, var. *alienus*. This ant is host and constant companion of the root louse throughout the year. It is equally devoted, however, to the common grass-root louse (*Schizoneura corni*, by Osborn's determination). The formicaries containing the corn louse eggs are most frequently to be found in old hills of corn, late in autumn or in early spring, at a time when the ants are torpid within the earth, and when, consequently, their mining operations do not betray their presence. They should be sought by digging or plowing up the corn stubble in the field, when, if ants be found, a thorough search of the burrows will commonly show the aphid eggs, piled together in larger or smaller quantities, the depth below the surface varying according to the season, and even the time of day. We have found them at a depth of 6 or 7 inches, and, again, scarcely more than half an inch below the surface. In spring especially, when hatching time draws near, the ants convey the eggs to the upper galleries of their nests during the heat of the day (particularly if the weather be fine), but withdraw them for the night and during cold wet days.

The ants themselves pass the winter as adult workers, and as larvæ in various stages from the minute young to those nearly full grown. The time of hatching of the plant-louse eggs varies, of course, with the season, ranging, according to our observations, from the 10th to the 30th of April. The commencement of the hatching season is fairly well indicated by the opening of the radical leaves of the common smartweed or heartweed (*Polygonum persicarium*) in the fields. The greater part of the eggs are commonly hatched a week or ten days before corn planting is fairly under way.

The aphids of the first generation, that hatching from the eggs, are, of course, wingless, oviparous females—the form commonly known as the stem-mother, or, by Lichtenstein's system, as the *Pseudogyne fundatrix*. This generation is readily distinguished by characters of form and color from all that follow. Hatching commonly before the corn appears it is dependent at first in our region almost wholly upon young plants of *Polygonum*. The roots of these are laid bare by the burrows of the ants, and upon these roots within their narrow tunnels the lice will usually be found thickly clustered. Later, if the field be not planted to corn, our common species of *Setaria* divides the attention of the lice, offering, in fact, for a little time, a more succulent herbage than the rapidly growing smartweed.

The second generation begins to appear about the 10th of May, and, by the 20th of that month may be itself mature. Many of this generation are winged, and others certainly wingless, as careful breeding experiments upon isolated individuals have proven again and again. Our earliest observation of the winged form of the root louse was dated May 13. This generation—the *Pseudogyne emigrans* of Lichtenstein—may

live at first like the other upon *Polygonum* and *Setaria*, but is most commonly transferred to corn, either in the same field or by flying to a distance. It is beyond all possible question a fact that the ants burrow the hills of corn industriously in advance of the appearance of these lice, and when they themselves have none in their possession with which to stock their burrows. That they will eagerly seize and convey to their cornfield formicaries root lice exposed to them we have repeatedly demonstrated by experiment. They seem, however, to be not wholly dependent upon this louse for food, since in the early spring, before the root lice make their start, the *Lasius* often captures small larvæ and various soft-bodied insects, which it kills and carries to its nest.

The third generation may appear from May 15 to 20. It is more generally winged than the second, so far as is indicated by our rather scanty observation.

The fourth and fifth generations were brought out late in May and early in June in the single experiment which we carried to that length, but the subsequent history of the louse has not been followed through the season in detail. It is only certain that successive broods appear throughout the summer until fall, breeding continuously upon the roots, and both winged and wingless viviparous females occur in variable proportions, seemingly determined in part by the condition of the plant upon which they feed, the winged lice being rapidly evolved as the corn plant suffers from the attack. The midsummer generations become, consequently, widely scattered, and the lice may almost disappear in fields where earlier in the season they were excessively abundant. Colonies started in old cornfields which have been planted to some other crop thus abandon them, after living for a time on smartweed, pigeon grass, and the like, and resort to the growing corn; but in midsummer the roots of many other plants become infested—purslane, *Panicum*, *Setaria*, and possibly squash, although our attempts to breed on corn root lice from this last plant were quite unsuccessful.

Even ragweed will support these lice at least temporarily, as we proved in 1889 by transferring half-grown young of the second generation from smartweed roots to ragweed, where they lived and fed until they acquired wings, five days later. In autumn we have found the last viviparous generation and the oviparous female following, on purslane, dock (*Rumex crispus*), fleabane (*Erigeron canadense*), black mustard, sorrel (*Oxalis stricta*), and the common plantain (*Plantago major*), not to mention two other plants not recognized or determined at the time.

The bisexual generation of root lice makes its appearance in cornfields as early as October 1, and continues there throughout the month, pairing and depositing eggs. Our only observation of the sexes *in copula* was dated October 21. We have not found the oviparous female anywhere in the earth except in the burrows of ants, and there, doubtless, the eggs are laid. Certainly they are collected at that season in the chambers of the ants' nests, and carried through the winter there

as already described. The assiduous industry with which the worker ants will search every crack and cranny of old corn hills in spring leads me to think, however, that they may perhaps find there scattered plant louse eggs, lost or overlooked in autumn.

The ants, in the meantime, have continued their development in their small and scattered colonies, the larvæ beginning to pupate by the middle of May and the sexes emerging early in August. Just when and where the eggs are laid by the fertilized female we have not yet determined, but specimens of this sex have been found in the earth, alive, as late as Nov. 1, and the continual appearance of young larvæ in the home nests until the middle of the following summer shows that eggs are laid, apparently by workers, at frequent intervals through the early part of the season.

The life history of the aërial corn louse, including its relation to the root form, has proven a particularly refractory subject, and is not yet complete. The connection of this form and the root louse as different stages of the same species was assumed without proof by the early observers, and has not yet been experimentally demonstrated; but, on the contrary, a great number of attempts at demonstration have almost completely failed. The leaf louse has never been certainly brought out of the root form, nor has the root louse been bred from the aërial form, and the evidence of a connection between the two is indirect and circumstantial; while the proverbial difficulty of proving a negative, and the fact that the annual origin of the aërial louse and the method of its hibernation are both unknown make a present conclusion unwarranted.

The winged root louse has been frequently taken on the leaves of corn during the month of June—from the 9th to the 24th precisely—and in the latter instances has been frequently found breeding there to some small extent; but attempts to raise these young on corn or broom corn, or to follow them in the field to the adult condition, have all thus far failed. On the other hand, the first observed appearances of the aërial louse (during the latter part of July) come after just about the interval required by the hypothesis of an origin from the winged root form.

The aërial aphid grows much more freely on sorghum and broom corn—especially the former—than on maize itself, but no experiments have as yet been made with the transfer of the corn root louse to the leaves of either of these plants.

In our large cloth-covered breeding cages inclosing corn abundantly stocked with root lice and ants, we have occasionally got an appearance and temporary continuance of the root form on the stalks or leaves, running up to a week with the usual production of young, and in two instances, out of about thirty experiments tried, aërial lice appeared later on the corn plants thus inclosed. A possible source of error appeared, however, in the fact that where the leaves of the growing corn pressed against the cheese-cloth covering, winged viviparous aërial lice

were seen crawling about outside, where their young might easily have passed through the meshes of the cloth and reached the plant within. This year, with a very large cage covering four planted hills thoroughly stocked with root lice there has not been a trace of the aërial louse; and all attempts to evolve it by directly transferring the root louse to the leaves have failed.

Passing now to the other end of the season, we find that the aërial lice continue to breed generation after generation of both winged and wingless viviparous females until the autumnal cold and the perishing of their food plants destroy them *en masse*, leaving behind no trace or remnant of a hibernating brood, nor evolving, so far as we have been able to discover, any oviparous generation. These aërial lice pass rapidly and freely from plant to plant in the fall, concentrating thus on the latest remnants of green vegetation about the corn, and spreading likewise to the perennial grasses around the borders of the field. We have dissected them by the hundred at this season, finding only females and these all viviparous, and have bred them in warm breeding rooms throughout the winter, no less than nine generations in succession occurring between October 7 and the 8th of March. In all these winter generations no trace of oviparous females occurred, and no variation of temperature or exposure made any appreciable change in the form or habit of the louse.

The aërial louse is extremely like the apple louse (*Aphis mali*), and its general disappearance in autumn from the corn at a time when this last species is laying its eggs freely on the apple twigs, led us to test the hypothesis of a migration between these plants. These experiments, persistently repeated, were, however, quite without result. The corn lice inclosed in autumn under bell jars with fresh apple twigs neither bred nor fed upon them, and invariably perished. Similar experiments have not been made, however, with either grass or wheat, although the aërial louse has been found in fall upon both. Besides a repetition of these and similar experiments, the most promising still to be made are those for the transfer of successive generations of the winged root lice in June and July to the leaves and springing tassels of corn and sorghum.

As long as the connection between root and aërial forms remains in doubt, all economic discussion must be of a provisional and tentative character. Some observations and experiments on the root louse are, however, worth reporting.

In the first place, a long list of observations in the field in early spring unite in showing that the corn-root aphid takes its start only in fields where it occurred the year before, and that such fields are, as a rule, most likely to suffer severely from the attack. The early evolution of a partly winged brood provides, however, for so general a dispersal that the expedient of rotation of crops can have only a secondary value.

Secondly, the fact that the plant-louse eggs hatch, as a rule, some days in advance of the growth of corn in the fields (usually a week or more before corn planting), and that in the meantime the lice are dependent on young weeds in the earth, gave the hint for some starvation experiments tried in two successive years. From these we learned that young lice just hatched will perish within five days if deprived of food, whether attended by ants or not. It seems possible, consequently, that their numbers might be greatly diminished in early spring by such a thorough stirring of the soil with disk harrows or other similar apparatus, as would keep down the sprouting herbage in the cornfield. Any treatment of the field the preceding summer or fall which should diminish the number of seeds of pigeon grass or smartweed maturing in the corn would diminish likewise the chances of survival of young root lice the following year. I am told that these conditions are agriculturally manageable, and have arranged for field experiments to test these methods.

A simpler and perhaps more promising expedient is based upon the care of the eggs of the common small brown ant, so frequently referred to. The attention which these eggs receive both in winter and spring makes it seem likely that the care of the ants is essential, and as these insects become torpid early, rarely working beyond November 1, it seems quite likely that late fall plowing of fields infested by them and their guests, the root lice, to be followed possibly by harrowing, would so break up their homes and scatter their treasures as to make it impossible for the ants to reestablish themselves or to collect the plant-louse eggs again. This supposition we shall presently test by treating in this manner a strip of land through an infested field and watching developments next spring.

In conclusion, I ought to say that in reporting these results I am acting only as the spokesman of the office, and that the main credit for the work done and much of that for the selection of methods and the devising of expedients should be distributed among Messrs. Garman, Weed, Hart, Marten, and Mally, all of whom, while acting as my assistants, have made important contributions to this subject.

NOVEMBER 13.—AFTERNOON MEETING.

Eighteen persons present. Dr. Riley in the chair.

The discussion on Mr. Forbes's paper was announced as in order.

Mr. Howard asked whether Mr. Forbes considered the apple-louse experiment a satisfactory piece of work.

Mr. Forbes thought it satisfactory as far as it goes, but hesitated to say that the negative was actually proven. Still the experiments were many times repeated, in doors and out, for two years.

Mr. Fletcher asked about the habits of the different broods of lice, and asked Mr. Riley whether the hop-inhabiting forms of *Phorodon humuli*, for instance, would live upon plum, if placed there artificially.

Mr. Riley said that experience showed that none of the generations on hop would live on plum, except the winged female destined to migrate to plum. He thought that we often can not do artificially what nature does in her own time and in her own way. That sometimes a species can not or will not colonize on another plant, to which it takes readily at another season. He thought that many of the species have an underground form during the summer, and that these forms in the same genus resemble each other very closely, much more than do the normal aerial types. Conclusions based upon comparisons merely are often unreliable. Were the experiments on the root forms so made that there was no danger of a mistake?

Mr. Forbes thought there was no chance of a mistake. They always bred these root forms upon corn, and so brought the biological method to bear, to supplement the systematic result. Often in the fall, where the root louse was on purslane, it would leave the roots and get upon the stem, which they covered thickly.

Mr. Riley said there was nothing more baffling than the study of these insects. That from the same parthenogenetic female may come divergent forms resulting in either apterous parthenogenetic individuals like the immediate parent, or in winged or wingless sexuparæ, and we often fail where we try to treat them just alike. Species vary in color and in characters, according to season or food plant, and comparisons and descriptions that take no account of these changes are of little value.

Mr. Forbes said the hypothesis that the apple and corn louse were forms of one species was a very alluring one, owing to the fact that the one seemed to disappear when the other arrived. The two species also very closely resemble each other, except in the poriferous system of the antenna.

Mr. Riley said that the apple louse (*mali*) has a summer form on the roots of grasses, and is found also on wheat in autumn.

Mr. Forbes thought it would be through the leaf lice or aerial forms that the apple and corn lice would be connected, if at all.

Mr. Riley thought it would be more likely, from analogy, through the root forms.

Mr. Forbes presented a paper entitled:

ON THE LIFE HISTORY OF THE WHITE GRUBS.

By S. A. FORBES.

Although there is a very great and steadily growing loss to the agriculture of this State (and doubtless in many others) due to the white grubs or "grub worms," there is among both farmers and entomologists a curious lack of self-consistent and trustworthy information concerning their life histories. In fact, some studies of their transformations begun by me in 1886 have led to the discovery that the biography of these insects most generally current in entomological literature is

erroneous and misleading in some important particulars, and that agricultural practices based on this inaccurate biography must be largely without beneficial effect.

If I were to say that the white grub lives for three years in the earth, counting from the May or June when the eggs are laid; that the grub or larva gets its growth in its third autumn, hibernates in the earth without transforming, pupates in the third spring of its life, and presently emerges as an adult, I should repeat in substance what has been many times said before, and my statement would probably pass even now without serious challenge. But this account would be quite inaccurate, at least as to the period of maturity and the time of transformation of the great mass of our white grubs, and might lead to unfortunate practical mistakes.

In fact, all the species of *Lachnosterna* which I have observed (to which genus the great majority of these grubs belong) get their full growth in spring and early summer, pupate in summer and early autumn, change in the earth to the adult beetle in fall, and hibernate there in that stage without escaping, finally crawling out of the earth for their brief life as "June beetles" in May or June, or rarely in July.

One practical bearing of this difference in history is easily seen. If the first account were correct, ground which contained full grown, active, and destructive grubs in late summer and fall might always be safely planted, so far as the grubs were concerned, to corn or potatoes or any other of the numerous crops subject to their attack, since by spring the insects would be too far advanced towards pupation to do any further injury; but in fact this is far from being the case, for a grub active in fall will also, if nothing interferes with it, be destructive in spring and well on towards or into the summer, and will thus have time the following year, before reaching the term of its larval life, to completely destroy either corn or small grain.

Furthermore, if the first account were correct, a farmer who finds his crop destroyed by full-grown grubs in spring need not hope to raise anything not grub proof on that ground that year; while the truth is that he may expect to see his field practically deserted by his enemies by July or even by late June, and may consequently plant some time previous to that without fear of harm.

The current and most authoritative statements of the life history of the white grubs are incomplete and more or less contradictory.

Dr. Harris says that "the habits and transformations of the common cockchafer of Europe have been carefully observed, and will serve to exemplify those of the other insects of this family, which, as far as they are known, seem to be nearly the same," and continues with a compiled account of the history of the European species* to the effect that the

* Several standard European authorities give quite a different account of the transformations of the European cockchafer from that quoted by Harris. Ratzeburg, Maurice Girard, and Taschenberg give for it a life history essentially like that of *Lachnosterna*, as here established.

larva gets its growth at the close of its last summer, penetrates about 2 feet into the earth, remains a pupa there until February, at which time it transforms to the beetle, and three months afterwards emerges to the light.* Referring to one of our most common species, now known as *Lachnosterna fusca*, he further says:† “In the course of the spring these beetles are often thrown from the earth by the spade and plow in various states of maturity, some being soft and nearly white, their superabundant juices not having evaporated, while others exhibit the true color and texture of the perfect insect.”

In a long account of the same species, Dr. Fitch remarks‡ that “early in spring, in spading or plowing the ground, these beetles are frequently exhumed, or sometimes in turning over a large stone one of them will be found beneath, lying in a smooth cavity or little round hollow in the dirt, like a chicken in its shell. This cavity or cell is formed by the grub the preceding autumn. Turning itself around and around, it presses upon and compacts the dirt and molds it into this cell for its winter residence; and in this cell it changes first to a pupa, in which the legs and wing-cases of the insect are seen in their rudimentary state, and afterwards to a beetle, such as we have above described. This beetle lies dormant in its cell until the warmth of the incoming summer penetrates the ground sufficiently to awaken it into activity. It then breaks from its prison and works its way out of the ground.” On another page he adds,§ “The history of our May beetle and its transformations have never been fully observed, but everything known respecting it concurs to show that it is exactly analogous to the cockchafer, or May bug of Europe (*Polyphylla melolontha*, Linn.), and occupies the place of that species upon this continent.”

Mr. Walsh, the first State entomologist of Illinois, says concerning the “white grub”||: “It lives several years in the larva state, and finally, in the early spring, changes into a dark chestnut-colored beetle.”

The fullest and most detailed of these earlier accounts, is that given by Dr. Riley, in 1869, in his first report as State entomologist of Missouri (p. 157):

Soon after pairing, the female beetle creeps into the earth, especially wherever the soil is loose and rough, and after depositing her eggs, to the number of forty or fifty, dies. These hatch in the course of a month, and the grubs, growing slowly, do not attain full size till the early spring of the third year, when they construct an ovoid chamber, lined with a gelatinous fluid, change into pupæ, and soon afterwards into beetles. These last are at first white, and all the parts soft, as in the pupa, and they frequently remain in the earth for weeks at a time, till thoroughly hardened, and then, on some favorable night in May, they rise in swarms and fill the air.

This is their history, though it is very probable, as with the European cockchafer

* *Insects Injurious to Vegetation*, 2d ed. (1862), pp. 27, 28.

† *Ibid.*, p. 31.

‡ Third Report on the Noxious and Beneficial Insects of New York (1859), p. 53.

§ *Ibid.*, p. 55.

|| *Practical Entomologist*, vol. i (1866), p. 60.

(a closely allied species), that, under favorable conditions, some of the grubs become pupæ, and even beetles, the fall subsequent to their second spring; but growing torpid on approach of winter, remain in this state in the earth, and do not quit it any sooner than those transformed in spring. On this hypothesis, their being occasionally turned up in the fresh beetle state at fall plowing, becomes intelligible.

Dr. Thomas gives no life history of the grubs in his Entomological Reports, but implies the transformation to the imago in spring in the following words:* “In April, when the ground is being plowed or spaded, often hundreds of them are cast out already in the perfect state, but then they are of a pale, creamy color;” and in an article on these insects published in the *Farmer's Review* of Chicago, for 1881, he expresses the opinion that full-grown larvæ destructive that fall will do no further harm, but will transform to the perfect insect the following spring.

According to Mr. Saunders,† “at the close of the third summer they cease feeding, and bury themselves sometimes 2 feet deep in the earth, and there, in an oval cavity formed by the motions of the larva from side to side, the change to chrysalis takes place, the beetle digging its way through and appearing at the surface in due season. Sometimes the transformation to the beetle state takes place in the fall, for we have several times found fresh specimens at this season, showing by their softness that they had but lately escaped from the pupa case. Such perfect insects secrete themselves under ground during winter, and appear with the rest of their troop in spring.”

My own contribution to this history of error was made in 1883 in a brief account of the white grubs as strawberry insects.‡ “The grubs hatch in the course of a month, and, growing slowly, do not commonly attain full size until the early spring of the third year, when they construct an ovoid chamber lined with a gelatinous fluid, change into pupæ, and soon after into beetles. Occasionally, however, individuals complete their transformation in the ground in autumn, and hibernate in the adult condition, without leaving their pupal cells, until the following spring.”

General accounts of the life history of the white grub consistent with the conclusions of this paper have been published, without distinction of species or other particulars, by Mr. David L. Bernard, in the Patent Office Report for 1852, and by Prof. G. H. Perkins, in the Second Annual Report of the Vermont Experiment Station (1888).§

The criticism to be made on most of these statements is substantially that the rule has been regarded as the exception and the exception as the rule. The only white grubs agriculturally destructive which we

* Sixth Report State Entomologist of Illinois (1876), p. 98.

† Report of the Entomological Society of Ontario, 1872, p. 18.

‡ Thirteenth Report State Entomologist of Illinois, p. 145.

§ Prof. John B. Smith has also noted, in the proceedings of the U. S. National Museum for 1888 (p. 487), the occurrence in October, 1887, of imagos of *Lachnosterna arcuata*, already perfectly colored and matured.

have so far found to pupate in spring belong to the genus *Cyclocephala* and, I need not say, are much less common than those of species of *Lachnosterna*, all of which, so far as I know, reach the imago stage in fall.

The following are the observations on which this statement is based :

(1) White grubs obtained from a timothy meadow at Champaign, March 24, 1886, had formed the pupa July 29, and September 17 were imagos of *Lachnosterna inversa*, in the earth of their breeding cage.

(2) Others obtained from a corn field at Anna, Ill., April 22, 1886, were found July 28 still unchanged, in their prepupal earthen cells, at the bottom of the breeding cage, but September 17 had transformed to the pupa, and October 9 were in part adult beetles, still in earth, of *L. implicita*, the remainder continuing as pupæ. These pupæ were placed in alcohol for specific description.

(3) Grubs obtained from plowed corn-ground April 27, 1886, at Urbana, Ill., and kept in a breeding cage, were finally examined September 17, by which time they had transformed to beetles still living in the earth in their pupal cells. These were identified as *L. inversa*.

(4) Grubs collected from the earth in a corn field at Champaign May 1, 1886, kept in the earth in a breeding cage and regularly supplied with food, had begun to pupate June 28, and had transformed in the earth to the imago of *L. inversa* by September 17.

(5) Specimens collected in June, 1886, from the university lawn at Champaign, where they had done immense damage to the turf, had pupated in part by July 28, but were not carried through. The larvæ are indistinguishable from those bred to *inversa*.

(6) Larvæ were collected at Champaign from the fields at intervals from April 2 to 22, 1890, and placed in a large breeding cage with earth and food. A trench was dug to a depth of $1\frac{1}{2}$ feet, inclosed by boards set to that depth in the earth and projecting 5 inches above it, and divided by board partitions into six compartments—all the joints being made quite insect-tight. The earth at the bottom of this trench was pounded very hard, and the whole refilled. A lot of larvæ from the above collections was put into one of these compartments April 24, the top of the inclosure being then covered with cheese cloth, and April 29 one more grub was added. July 24 one pupa and several larvæ were found in the cage; September 5 adults of *inversa*, *rugosa*, and *hirticula*, and a single pupa were taken from the earth in it; and, finally, September 26, when the compartment was cleaned out, three more examples of adult *hirticula* were found.

(7) Another selected lot of the same grubs were placed, April 24, in another compartment of this trench, and to these a single larva from a corn field was added May 7. Nothing was seen of this lot until September 7, when two adults of *L. gibbosa* were found 8 inches below the surface, beneath the pounded earth bottom of the cage.

(8) April 28, 1890, a large lot of grubs was collected from a field of growing corn 3 miles west of Champaign, 2 or 3 acres of which had been completely destroyed. The next day ninety-three of these grubs were put into the trench cage. This lot of larvæ was examined May 31, June 23 (at which time five were separated for more frequent observation), and July 1 and 2, the larvæ all continuing active until the latter date, at which time one was shortened in its earthen cell. This larva was separately watched, and found dead, as a pupa, July 18. July 15 and 18, no pupæ had appeared in either of the other lots, but July 24 two of the five, separated as above, had pupated, two others had formed their cells and shortened up, and one was dead. August 5, these were all dead without further change. In the main lot, the first pupæ were found July 25. August 12, larvæ and pupæ were seen, but no imagos, and September 4 the cage contained several dead pupæ and two adults of *rugosa*, four more of which were taken out September 26.

(9) In a compartment of the breeding trench, just described, in which no grubs were put, two pupæ and one larva were seen July 24, (apparently having made their way under the partition from a cage adjoining,) and September 25, two of these were beetles of *L. inversa*, and one was a pupa of the same species.

(10) Collections made September 15, 1890, from the same field from which the larvæ were taken in April for the above experiments, were all larvæ and adults (no pupæ occurring), the latter both *rugosa* and *inversa*.

Generalizing the above breeding-cage experiments, we learn that pupæ *Lachnosterna implicita*, *inversa*, *rugosa*, *hirticula*, and *gibbosa* have been found by us in the earth from June 28 to October 9, but not earlier and not later; and that imagos of these species have occurred in the same experiments from September 5 (their earliest noted appearance there) to October 9, beyond which date the breeding-cage work was not continued.

The dates at which the adults of *Lachnosterna* have been observed by us in the earth outside bear out in every case the manifest teaching of these breeding-cage results. *L. fusca* we have found as an imago, still in its pupal cell, August 11, October 25, November 28, March 24 and 28, April 1, 2, 4, 5, 8, 9, 10, 11, 12, 14, 15, 16, 21, 23, and 27, and May 1. *L. fraterna*, June 6; *gibbosa*, August 11, May 6 and 8; *hirticula*, August 12, March 27, April 5, and May 1; *ilicis*, only April 12; *inversa*, October 28 and March 27, April 2, 4, 5, 8, 9, 12, 14, 15, 16, 20, 21, and May 8; *rugosa*, September 15, October 28, March 24, and April 22 and 23; *tristis*, March 28, April 8, 12, 14, 16, 20, and May 1 and 16; *arcuata* we have taken from the earth only December 4.

Taking into account, now, the fact that in all our collections of these imagos, extending through five years, not a single pupa was discovered except in the interval between June 28 and October 9, as stated above, we see that all the observations made by us on the transformations of

Lachnosterna show that the common species of this genus pupate and emerge in the latter half of the growing season, as adults in the earth.

The genus *Cyclocephala*, on the other hand, has the other habit, if we may judge from our own observations on *C. immaculata*, made in 1887, 1888, and 1890.

For example, grubs of this species collected in grass lands at Urbana, April, 1887, had all emerged as adults July 19; others collected from cornfields April 25, 1888, had pupated, at least in part, June 20, and afterwards gave the imago—at what date is not known.

In April, 1890, grubs were collected from the 6th to the 29th, all of which but one had pupated by June 4, and all had emerged July 19.

A dozen of the imagos of this collection being placed in a breeding-cage and furnished regularly with fresh sods, had laid numerous eggs among the grass roots July 2, and five days later one of these had hatched. July 26 several young larvæ were living and doing well, but by August 10 all had died.

Distinguishing larval characters, at least of genera and subdivisions of genera, are to be found in the last segment of the abdomen. *Cyclocephala* may be told at a glance from *Lachnosterna* by the fact that its supra-anal plate is very much larger and that its vent is a transverse slit, while in *Lachnosterna* this opens beneath a triangular flap, making a large V-shaped slit. Larvæ of the latter genus may be subdivided to a considerable extent, although not always as to species, by differences in the hairy clothing of the under surface of the last segment, in front of the vent. There is here a median longitudinal avenue of short blunt spines (lacking in *Cyclocephala*), which differ constantly in respect to the size of the spines, their number and distance in a row, their direction, and the distance of the rows from each other.

There are also differences here in the extent and density of the coat of bristle-like hairs, many of them hooked at tip, which largely clothe the surface on each side of these median rows. By these means my assistant, Mr. Hart, whose duty it has been to assort the white grubs collected into provisional species for the breeding cages, has clearly discriminated five groups, the differences in which appear constant at all ages. One of these groups was subsequently bred to both *hirticula* and *rugosa*, one to *inversa* and one to *gibbosa*, but the other two we have not yet brought to the adult. The form from which we have obtained *inversa* almost certainly represents *fusca* also, as it is much the commonest grub, and this is the commonest imago with us; but, curiously, *fusca* has not yet appeared in our breeding cages.

Mr. Smith said that he had made the same observations relative to the transformations of the white grubs in fall some years since and published it in his *Lachnosterna* paper in the proceedings of the U. S. National Museum. It was also announced at the time at a meeting of the Entomological Society of Washington.

Mr. Howard stated that he remembered Mr. Smith's announcement and the general expression of opinion at the meeting that this fall transformation is a very common thing.

Mr. Forbes admitted that the matter had been observed before, but that it seemed to have been considered the exception rather than the rule.

Mr. Riley said he had published in his later writings that *fusca* commonly transformed in autumn, but thinks it not the invariable rule. He has also bred *Cyclocephala immaculata*, and had reached the same result as to period of transformations that was reached by Mr. Forbes. He had tried to find differences between the larvæ, but had sought them in the mouth parts.

Mr. Forbes had examined the mouth parts until he was nearly distracted. There were differences, but they were not constant and he had abandoned that line of research.

Mr. Hart read the following paper:

THE LIFE HISTORY OF WIREWORMS.

By C. A. HART.

[Author's abstract.]

Mr. C. A. Hart then read a paper on the "Life History and Immature Stages of Elateridæ," the material for which was drawn from the collections and notes of the State entomologist's office. Eight species of *Melanotus* were mentioned as occurring in these Illinois collections—most of them tolerably common—viz, *americanus*, *infaustus*, *pertinax*, *parumpunctatus*, *depressus*, *cribulosus*, *communis*, and *fissilis*. Larvæ of Elateridæ are divisible into about three principal groups according to their general form and the shape, finish, structure, and armature of the last abdominal segment. Larval characters were given for *Alaus*, *Cardiophorus*, *Elater*, *Drasterius*, *Ludius*, *Agriotes*, *Melanotus*, *Corymbites*, and *Asaphes*. Use was made of the so-called muscular impressions in separating species of *Melanotus*, among which *communis*, *fissilis*, *cribulosus*, and *americanus* were recognized in the larva.

A larva, doubtfully identified as *Lacon rectangulus* was found injurious to corn, as were also those bred to *Agriotes mancus* and *pubescens*, and *Melanotus communis*, *fissilis*, *cribulosus*, and *infaustus*.

Biographical memoranda were given for *Ludius attenuatus*, and for the species of *Melanotus*, *Agriotes*, and *Asaphes*.

This paper will be published in an elaborated form, with illustrations, in the bulletin of the Illinois State Laboratory of Natural History.

Mr. Cook said he planted buckwheat one year in an infested field, and it was not injured at all; but next year they injured the oats planted in the same field. Evidently one year will not suffice to starve them out.

Mr. Gillette thought that the characters of the anal plates relied upon by Mr. Hart should be figured when the paper is published. He has found wire-worms predaceous on the potato stalk weevil.

Mr. Bruner had taken several different forms of wire-worms out of rotten wood at West Point, Nebr. He has also found them killed by the white grub fungus, *Cordiceps*.

Mr. Fletcher presented the following :

NOTES UPON INJURIOUS INSECTS OF THE YEAR IN CANADA.

By JAMES FLETCHER.

[Author's abstract.]

Cutworms of various kinds had been locally abundant. *Agrotis turris* had been destructive in gardens to flowers and vegetables. *Hadena arctica* and *H. devastatrix* had injured fall wheat and grasses in the spring. He was more than ever in favor of the poisoned trap remedy for cutworms. The caterpillar of *Pieris rapæ* had been very troublesome but was easily destroyed with pyrethrum powder diluted with four times its quantity of common flour or slacked lime. *Plutella cruciferarum* had also done much harm to cabbages in the northwest territories and in British Columbia. This had been much more difficult to destroy with pyrethrum than the last named. The cabbage-root maggot had attacked cabbages severely; but had been successfully destroyed by syringing about half a cupful of hellebore tea round each root and then hoeing the soil well up round the stem. He had made some interesting studies of the Hessian fly, which agreed in the main with those published by Prof. Forbes in a recent bulletin. Spring wheat, sown in the end of April, had been attacked at Ottawa at the root in the same way as wheat is injured by the autumn brood. From these same wheat plants he had bred the Hessian fly, the wheat-bulb worm, and *Oscinis variabilis*. Insects injurious to fruit trees had been represented by the plum curculio, the codling moth, the leaf roller of the apple, and the cankerworm. All of these had been successfully treated with Paris green.

Some observations on forest insects had shown him that the large cerambycid larvae from eggs laid early in the season produced the perfect insects the next year; but those laid late passed two years before coming to maturity. He had taken a female of *Monohammus confusor* with the abdomen filled with eggs as late as the middle of September. The attacks of *Nematus erichsonii* on larches in the Provinces of Quebec and New Brunswick were described.

Mr. Webster asked whether Mr. Fletcher had ever seen the larva of *Agrotis fennica* feeding on grains?

Mr. Fletcher replied that it feeds primarily on clover; but when occurring in numbers is almost omnivorous; asparagus beds, raspberries

and strawberries were injured by it; some young forest trees in the nursery had the terminal buds attacked.

Mr. Cook said the larva eats everything. It becomes fully developed on blue grass and timothy; he does not know positively that grain was attacked; all garden produce was eaten.

Mr. Smith replied to Mr. Fletcher's query as to the best method of using pyrethrum, that he had found it most satisfactory in water.

Mr. Beckwith had used it very successfully with lime.

Mr. Fletcher asked whether the powder was not as a rule better than the water mixture. He had found it so in his experience.

Mr. Cook had found the water mixture of pyrethrum more effective.

Mr. Gillette said that he had found the dry pyrethrum much more effective than the water mixtures, especially if applied in the cool of the day.

Mr. Summers found that the difficulty with the water mixtures seemed to be in making them stick; he asked whether the addition of soap would make them adhere better.

Mr. Fletcher said it would for such plants as threw off liquids by reason of waxy coatings on the leaves, etc.

Mr. Cook asked in reference to traps for cutworms, whether Mr. Fletcher still makes up his lures in bundles. He has found it most satisfactory to put alternate layers of grass and poison on a platform wagon, and then pitch it off with a fork.

Mr. Fletcher said, yes, he not only still tied it up in bundles, but even went to the trouble of putting a shingle upon it. It keeps fresh so much longer and seems to be more attractive. The arsenic acts very slowly, but very surely. The worms will burrow out of sight if they feel themselves sick, and the bait may seem to have done no good. But if the earth beneath the bundle be scraped away the worms will be found dead or dying. They sometimes wander away to die; some were found 4 feet away from the bundles, the Paris green being distinctly visible in the alimentary canal. He described how he checked damage in a turnip field by these lures. Three quarts were gathered next day from a few of the traps, all of which died in a few hours.

Mr. Cook said one practice is to spray a patch of clover and then mow it. He uses clover very largely.

Mr. Fletcher said clover was a very unsatisfactory plant for him. It is often not possible to get it early in the season when needed, and the poison does not stick so well as it does to other plants. He always recommends succulent plants, but is careful to tell the farmers that they can use almost any weed growing around fence corners. He had found pepper grass (*Lepidium virginicum*) a very attractive plant. Lambs' quarters (*Chenopodium album*) is also greedily eaten by cutworms, but it is difficult to make Paris green adhere to it. For such plants it is necessary to rub a little soap in the water before mixing it with the Paris green with which the traps are to be poisoned.

Mr. Cook said he had found mullein about as attractive as could be for cutworms; they will take it in preference to anything else.

Mr. Beckwith asked about the pupating habit of the cankerworm. He has seen the statement that they pupate in a cocoon; the specimens bred by him all formed naked pupæ.

Mr. Riley said it depends on the species of cankerworm. *Paleacrita vernata*, if he recollects aright, has no cocoon, or a very fragile one; but the autumnal species (*Anisopteryx pometeria*) has quite a tough cocoon. For the former, fall plowing is a good remedy.

Mr. Harvey confirmed the statement that the fall species forms a cocoon, and stated that it is rather a thin covering of silk covered with grains of sand or earth. In this connection he remembered that some of the orchardists in his State claim that they prevent injury from the borers by rubbing the base of the tree with the hand.

Mr. Smith said that in his experience *S. candida* is by no means confined to the base of the trees. He finds them in all parts of the trunk of quince, entering apparently from some distance above ground.

Mr. Riley thought they very rarely oviposit much above the base, though when they get into the trunk they often bore upward some distance.

Mr. Cook said that he had taken both *candida* and *cretata* even in the branches.

Mr. Osborn said that he also finds *cretata* in the branches.

Mr. Riley said this preference of *cretata* for branches agreed also with his experience.

Mr. Harvey said that he finds both roundheaded and flatheaded borers at the base of the trees. There has been considerable injury caused during the year on the branches of blackberry by a larva which seems to be that of *Tmetocera ocellana*. He has found no record of this species attacking blackberry and this habit is apparently new.

On motion of Mr. Howard it was resolved that the proceedings be published in INSECT LIFE.

The association then adjourned.

JOHN B. SMITH,
Recording Secretary.

LIST OF MEMBERS OF THE ASSOCIATION OF ECONOMIC ENTOMOLOGISTS.

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 M. H. Beckwith, Newark, Del.
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 C. W. Hargitt, Oxford, Ohio.
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 Clarence M. Weed, Columbus, Ohio.
 E. V. Wilcox, Columbus, Ohio.
 C. W. Woodworth, Fayetteville, Ark.

SPECIAL NOTES.

We had hoped, as announced in No. 5, that the present number would be issued almost simultaneously with that number, in order that the reports of the two Champaign meetings might appear about the same time. The delay in publishing the current number results from circumstances which could not then have been anticipated.

Entomology at the Iowa Station.*—In Bulletin No. 11 Mr. Gillette has four entomological articles. He summarizes what is known concerning the Potato Stalk-weevil (*Trichobaris trinotata*), and states that this insect has been one of the worst insect pests of the past season. He believes that half a million dollars will fall far short of making good the loss it has occasioned the State of Iowa in the past year, from its injuries to the potato crop. He also publishes some remarks upon the Apple Curculio (*Anthonomus 4-gibbus*), recording some original and careful observations upon the methods of egg-laying. He also records a new Currant stem-borer. This is *Hyperplatys aspersus*, a longicorn beetle, which has long been known as an enemy to Cottonwood. The principal article of the Bulletin, however, is a consideration of kerosene emulsion as a sheep dip and as a destroyer of parasites upon domestic animals. Mr. Gillette has already made some experiments in this direction, and we have noticed his previous reports. He has recently experimented upon sheep on a large scale, drawing the conclusion that a good kerosene emulsion, of sufficient strength to kill parasitic insects, can be used safely upon sheep without removing or injuring the fleece, but that an emulsion of poor quality should not be used, as it would probably cause the sheep to lose much of their wool. He has also applied the emulsion to horses, cattle, and hogs, with the result that, in every case, the coat has been either unchanged in appearance or made more sleek and glossy, while the skin is left clean and soft. The experiments are of value principally in that the kerosene emulsion, as ordinarily prepared, costs not over 90 cents per 100 gallons, and is, on an average, about one-fourth cheaper than any of the patented sheep-dips.

* Bulletin No. 11, November, 1890. Des Moines, Iowa, 1890.

Fossil insects.*—We have recently received under one cover four papers by Mr. Scudder, giving the results of his studies upon fossil insects. The titles are as follows: New Types of Cockroaches from the Carboniferous Deposits of the United States; New Carboniferous Myriapoda from Illinois; Illustrations of the Carboniferous Arachnida of North America, of the Orders Anthracomarti and Pedipalpi; and The Insects of the Triassic Beds at Fairplay, Colorado.

Two very handsome lithographic plates illustrate the first paper, 6 are devoted to the second, 3 to the third, and 2 to the fourth.

The papers are purely descriptive and contain few or no generalizations.

Dr. Lintner's sixth report.†—Although shorter than his previous reports, with the exception of the third, Dr. Lintner's sixth report brings together a number of well-illustrated and attractively written articles upon the insects which have been brought to his attention since the publication of his previous report. The principal insects considered are the Ox Warble-fly, the Bacon Beetle, the Pea Weevil, several Blister Beetles, the Cottony Maple Scale, the Mole Cricket, and the Red-legged Grasshopper. One of the most interesting points brought out is the further damage to honeycomb by *Dermestes lardarius*, the only previous mention of which was published by Dr. Riley in the second volume of the *American Entomologist*.

Dr. Lintner exhibits his customary care in reviewing the literature of each insect considered, and in this, as in many other respects, his reports are models which could be followed to advantage by many of our younger writers.

He also publishes as usual, in appendix form, the useful list of his publications during the year. The report covers about one hundred pages and is illustrated with twenty-five cuts, most of which we are glad to notice are duly acknowledged.

Maskell on Coccididæ, Psyllidæ and Aleurodidæ.—We have recently received from the author the following valuable papers, read before the Wellington Philosophical Society, October 2, 1889, and published in the Transactions of the New Zealand Institute, vol. XXII, 1889: Art. XVI, Further Notes on Coccididæ, with Descriptions of New Species from Australia, Fiji, and New Zealand; Art. XVII: On some Species of Psyllidæ in New Zealand; and Art. XVIII: On some Aleurodidæ from

* Memoirs of the Boston Society of Natural History, Vol. IV, No. 9. Boston, September, 1890.

† Sixth Report of the Injurious and other Insects of the State of New York, by J. A. Lintner, PH. D., State Entomologist, Albany, N. Y., 1890. Extracted from the forty-third report of the New York State Museum of Natural History.

New Zealand and Fiji. The first paper is supplementary to the author's book on the Scale Insects of New Zealand, and comprises descriptions of new species and notes on those formerly described or on introduced species, among which is mentioned *Mytilaspis citricola* Pack., which was found on oranges received from Fiji. Six plates illustrate this paper. Four new Psyllidæ are described in the second paper, which is illustrated by three plates, and in the third six new species of *Aleurodes*, with one plate.

We regret to notice the confusion which Mr. Maskell has introduced into the now well-settled matter of arbitrary terminations for the higher groups and his abandonment of the accepted names "sub-family" and "tribe," for the extremely indefinite terms "group" and "subdivision." He also and quite unaccountably calls the Coccidæ "Coccididæ." He has apparently adopted the plan of giving each of his group (subfamily) names the termination "idinæ" regardless of the declension of the noun from which it was derived. This would not be noticed in the case of "Diaspidinæ," which has hitherto been incorrectly written "Diaspinæ," but it becomes an absurdity in the case of "Lecanidinæ" and "Coccidinæ." Worse still is his use of the universally accepted family termination "idæ" for his "subdivisions" (tribes), bringing about such names as "Lecanidæ" and "Acanthococcidæ," which in his own signification have only tribal value. There is no danger that anyone will follow Mr. Maskell in such eccentricities, and we call attention to them simply to obviate a possible misconstruction of any of his shorter writings in which these terms may be used.

Professor Harvey's Bulletin on the Apple Maggot.*—One of the best pieces of work which has been done by the experiment station entomologists in the past year has resulted in the publication of this paper by Professor Harvey. He has outlined a careful investigation and carried it through successfully, and has presented his results in a straightforward, scientific, and readable way. He gives for the first time accurate observations upon the eggs, careful studies of the reproductive system, observations upon the act of oviposition, and a list of sixty-six varieties of apples infested by the maggot, with comparative statements as to damage. His summary of the life-history is very careful, and his consideration of the remedies includes an account of the useless methods, the preventive measures, and the direct methods. He follows with some critical remarks upon the anatomy of *Trypeta*, and a summary of the previous writings upon this insect, correcting the numerous errors

* The Apple Maggot: A consideration of the literature, history, distribution, transformation; life history, and habits of this insect; also remedies. The results of investigations made in 1888 and 1889, by F. L. Harvey, M. S. Extracted from the Annual Report of the Maine Agricultural Experiment Station, 1890.

which have occurred in print. He rightly claims for himself the credit of recording for the first time—

(a) The discovery of the eggs; the number of eggs the female deposits; that the eggs are inserted from *time to time*, one in a place, by means of a *sharp* ovipositor, through the skin of the apple; that the eggs are deposited in the fruit *before it is ripe* and in early fruit in early July; the time required for the eggs to hatch.

(b) That the larva becomes full grown in from 4 to 6 weeks; that they leave the apple through characteristic openings in the skin, and on grassy ground probably hibernate about the grass roots; that the larvæ stored in fruit leave it and assume the pupa state in the bins or barrels; that they occur in the fruit earlier and during a longer time than before recorded.

(c) That the flies are on the wing longer than before recorded; that the later races of flies affect the later fruit.

The article is illustrated by four plates, upon which are several new and interesting figures. We reproduce his figures of the egg puncture; of the channels made by the half-grown and full-grown larvæ; of the exit hole of the larvæ; of the egg; of the female ovipositor and of the external genital apparatus of the male.

Miscellaneous Notes from the Ohio Station.*—In the September, 1890, Bulletin of the Ohio Station, Mr. Weed has four short entomological notes, entitled (XIX) Plum Curculio Experiments, (XX) Remedies for Striped Cucumber Beetle, (XXI) The Rhubarb Curculio, and (XXII), The Clover Stem Borer. In Article XIX he details a commercial experiment on a large scale, half of an orchard of nine hundred five-year-old plum trees being sprayed and the other half jarred, the writer concluding that the spraying was as efficient as the jarring while it is much cheaper and easier of application. Moreover, the sprayed trees seemed free from the plum-leaf fungus (*Septoria cerasina*) and the Brown Rot (*Monilia fructigena*). In Article XX an account is given of experiments with certain insecticides and with two gauze net frames, Mr. Weed concluding that tobacco powder, liberally applied, is the most promising insecticide, while the simple methods of mechanical exclusion are practical and efficient. In Article XXI the life-history of *Lixus concavus* is given, and our note on p. 294 of Vol. II of INSECT LIFE is heeded to the extent of a republication of the references to previous accounts of the food-habits of this weevil. Article XXII adds ten food-plants to the list of those previously recorded for the Clover Stem-borer (*Languria mozardi*). These are: *Melilotus alba*, *Erigeron philadelphicus*, *E. canadensis*, *Oniscus altissimus*, *Lactuca canadensis*, *L. floridana*, *Rudbeckia laciniata*, *Achillea millefolium*, *Campanula americana*, and *Urtica gracilis*.

* Bulletin of the Ohio Agricultural Experiment Station, second series, Vol. III, No. 8, September 1890.

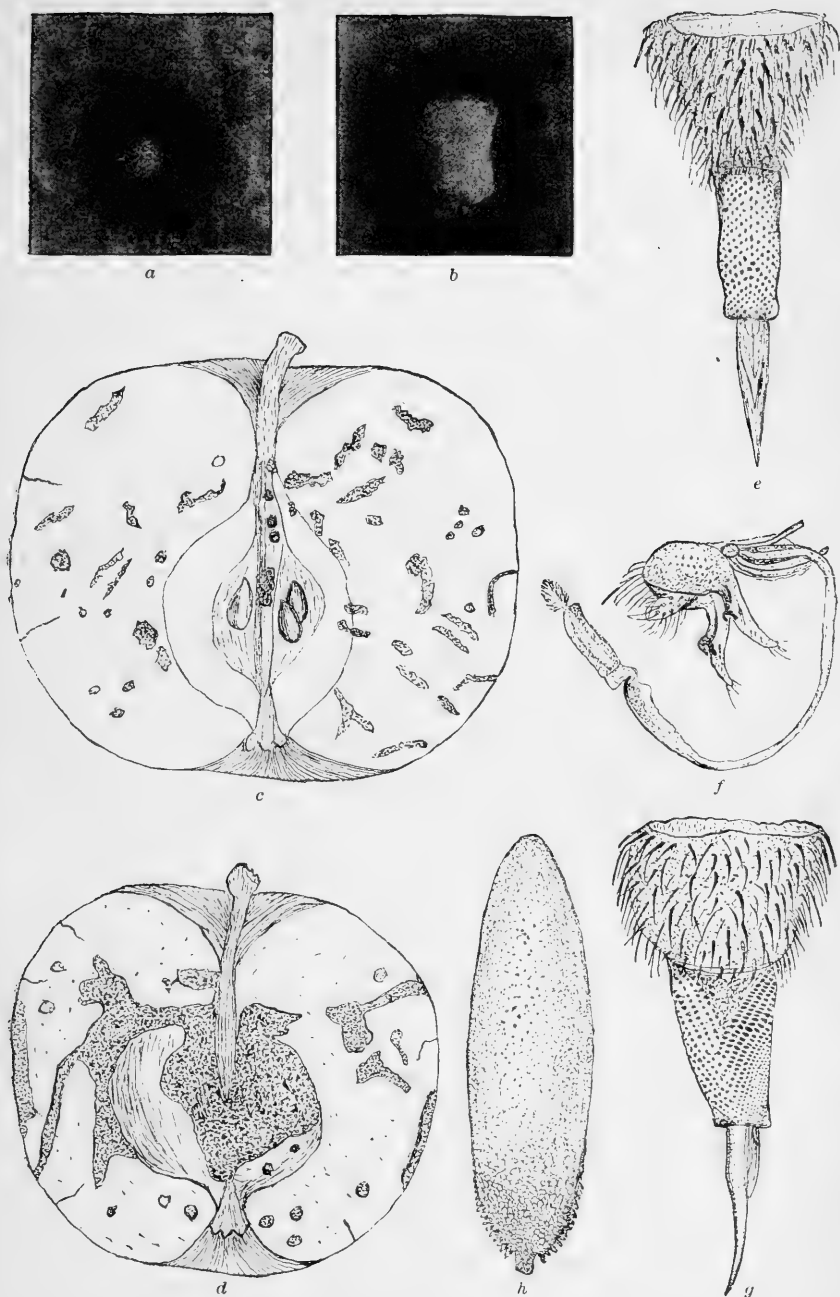


FIG. 22.—*Trypeta pomonella*: a, Apple peel showing puncture by female ovipositor—enlarged 30 times; b, exit hole of larvæ—x 5; c, work of half-grown larvæ; d, work of full-grown larvæ—nat. size; e, ovipositor from below; g, seen from side; f, male genitalia—x 30; h, egg—greatly enlarged; (after Harvey).

Some hitherto unnoticed publications of the Agricultural Experiment Stations.—Bulletin 10, of the Minnesota Station for March, 1890, contains an article by Professor Lugger on "Oak Caterpillars," eight species being mentioned, with an account of the life-history of each and two original plates showing the larva and moth of each species. These in the order of their importance are: *Anisota senatoria*, *A. virginiensis*, *Datana ministra*, *Edema albifrons*, *Janassa lignicolor*, *Perophora melsheimeri*, *Apatela brumosa*, and *Gastropacha americana*. The article contains, besides the plates, five other original figures and presents the matter in an admirable way. The same bulletin also contains an article by Prof. Samuel B. Green on syringing with London purple for the Curculio on native plums, his experiment having proved very satisfactory and showing that the crop of native plums can be as much improved by the proper use of insecticides as any of the European stock varieties.

Bulletin 5 of the Oregon Station for April, 1890, gives a resumé of injurious insects by Prof. F. L. Washburn, the most important treated being the Codling Moth, Woolly Apple-louse, Pear Slug, Peach Borer, San José Scale, Flat-headed Apple-borer, Gooseberry Fruit-worm, Currant-borer, Pea Weevil, Cut Worms, and Grain-beetles. Remedies are outlined and details of rather elaborate experiments given for ridding granaries of Grain-beetles (*Silvanus surinamensis*). The article is accompanied with many illustrations, and is followed by an article from the same author on gophers and rabbits with remedies and poisons for the same.

Bulletin 9, of the Florida Station, for April, 1890, is entitled "Entomological Notes" by Dr. James C. Neal. He treats among others the Root-knot Worm, Cut Worms, Cotton Worm, Boll Worm, Cotton Stainer, Leafy-legged Plant-bug, Orange Scale insects, Cabbage Butterfly, and a number of insects injurious to forest trees. Formulæ for spray solutions and powders are published, and the bulletin closes with a notice of certain insects not yet reported but which are liable at any time to make their appearance in the State.

Prof. A. J. Cook presents Bulletin 58, March, 1890, of the Michigan Station, a rather full account of the leading substances used as insecticides. The arsenites, kerosene emulsion and ointment, pyrethrum, carbolic acid emulsion, carbolized plaster, Bordeaux mixture, white hellebore, bisulphide of carbon, tobacco decoction and cyanogen are considered, and the bulletin will be of great use to the practical farmer and grain dealer. Under a misapprehension, the author claims credit for the first use of kerosene emulsion. The true status of this claim was shown at the late meeting at Champaign, the proceedings of which are published in this number.

Prof. John B. Smith has published a two-page bulletin, giving two spray solutions to be used against the Wheat Aphis in cases of extreme

damage (Bulletin 67, New Jersey Station, May 3, 1890). One of these is a kerosene emulsion and the other a fish-oil soap, which it is claimed will also kill the Cabbage Aphis.

The Effects of Arsenites upon plants.*—Mr. C. W. Woodworth, the entomologist of the Arkansas Experiment Station, has published a little fourteen-page bulletin under this head. His methods seem to have been careful and his conclusions appear justified from his experiments, although in some respects they differ from those reached by Gillette and other recent experimenters. We give his conclusions in full:

(1) The injury from white arsenic is seen comparatively very soon after it is applied. London purple is almost as active.

(2) Paris green does its injury much more slowly.

(3) Young leaves are affected much more quickly than are the old ones.

(4) Applications to the lower side of a leaf produce injury more quickly than if the poison is applied above.

(5) Except in the case of young leaves, it seems to be the rule that where the greatest injury is produced, a greater proportion is early apparent.

There are certain conclusions of practical importance that deserve to be emphasized.

Where the plant is easily injured, and the choice is between Paris green and London purple, *Paris green is better in every particular.*

Spraying with the arsenites has become a recognized part of the culture of some plants. With such plants *varieties could be produced by selection to which strong poisoning would do no injury.*

When as is often the case it would be as effectual, it should be remembered that *a light spraying from above is the safest.*

Plants can be sprayed with equal or more safety when the leaves are young than later in the season.

Freshly mixed white arsenic promises to be one of the very best of the arsenites and at the same time the cheapest.

*Arkansas Industrial University Agricultural Experiment Station, Bulletin 14, September, 1890.

PROCEEDINGS OF THE PERMANENT COMMITTEE ON ENTOMOLOGY OF
THE ASSOCIATION OF AMERICAN AGRICULTURAL COLLEGES AND EX-
PERIMENT STATIONS.

CHAMPAIGN, ILLINOIS, *November 11, 1890.*

Called to order by the chairman, S. A. Forbes.

C. P. Gillette was elected secretary.

The committee proceeded at once to the reading of papers, the first being by C. P. Gillette as follows:

**NOTES ON CERTAIN EXPERIMENTS AND OBSERVATIONS AT THE
IOWA EXPERIMENT STATION.**

By C. P. GILLETTE.

TO PREVENT SQUIRRELS FROM PULLING CORN.

A series of experiments in treating corn with various substances to prevent its being taken by the striped squirrels were carried on at the Iowa Experiment Station, last spring. The corn was treated in the following manner: Smoked with meat in an ordinary smoke-house until the kernels were black; smoked in a barrel with tobacco dust; smoked over night in strong decoctions of tobacco and of quassia chips; soaked in a dilute carbolic acid mixture, in strong alum water, in salt water, and in kerosene. The squirrels would take the corn treated in any of these ways, though the carbolic acid treatment and the smoking with tobacco made the corn distasteful, and when in the vicinity of other grain would be left till the last. The best remedy seems to be to harrow the ground immediately after planting to cover the planter tracks, and then to scatter corn about the border of the fields and in the vicinity of the squirrel holes as soon as the corn begins to come up.

KEROSENE EMULSION AS A SHEEP DIP.

An 8 per cent. kerosene emulsion was used, in which to dip the sheep on the college farm the past summer, and it was fully proven that a good emulsion can be safely used for this purpose, even when sheep have considerable wool upon their backs. As the kerosene emulsion is much cheaper than the commercial sheep dips, this seems to be a matter of considerable importance to sheep growers.

THE SCURFY BARK-LOUSE.

The Scurfy Bark-louse, *Chionaspis furfurus*, was very abundant in the college orchard last fall. In the spring kerosene emulsion and rosin mixture, the latter prepared according to the formula given by Mr. D. W. Coquillett in the Report of the Department of Agriculture for 1888, were used to test their effects upon the scales and the newly hatched lice. The application did not destroy the eggs beneath the scales, but when applied to the newly hatched lice both were very effectual in destroying them. Two lady birds, *Chilocorus bivulnerus* and *Hyperaspidius* sp., were constantly preying upon the scales in large numbers.

EXPERIMENTS WITH THE ARSENITES.

The experiments with the arsenites were so fully reported in Bulletin 10 of the Experiment Station that I will only call attention to them here, and state that several applications of London purple and of Paris green in lime water and in Bordeaux mixture have been made upon tender foliage since the experiments reported in Bulletin 10 and with the same results.

CUT-WORM PARASITES.

The following parasites have been bred from cut-worms the past year: three species of Tachina flies, one species of Anthrax, *A. scrobicularia*?, determined by Dr. Riley; *Ichneumon wilsoni*, determined by Dr. Riley, *Lampronota americana*, *Rhogas rileyi*, *Apanteles xylinæ*, determined by Dr. Riley, *Liothorax melanocera*, determined by Mr. Ashmead, and a species of *Ichneumon* not yet determined.

INSECT DISEASES.

The larvæ of *Nephelodes violan* and of *Pieris rapæ* have been very largely destroyed at Ames, Iowa, the past year by bacterial diseases. Diseased larvæ of *Danaïd archippus* and of *Plusia brassicæ* were also seen.

THE POTATO STALK-WEEVIL.

The Potato Stalk-weevil, *Trichobaris trinotata*, has been extremely abundant in central and eastern Iowa, at least the past summer. No patches could be found that had not suffered from a severe attack, and in gardens nearly every potato stalk was infested.

PYRETHRUM EXPERIMENTS.

Two years ago I put a small quantity of pyrethrum in an open box and covered it with cheese cloth, and this box has been left exposed ever since. This fall I used the old pyrethrum alongside of a fresh article to determine their comparative effects for the destruction of the cab-

bage worm, *Pieris rapæ*. The old powder had settled together into a sort of brick, and there seemed to be very little of the fine floating dust in it, and when applied dry to the larvæ would seldom kill one, but when applied in water it did nearly as well, but not as well as the fresh powder. This old pyrethrum was then ground very fine in a mill used in the chemical laboratory for the purpose of grinding vegetable fibers, and then applied to other larvæ and nearly every one that was well dusted with this powder was destroyed, but it was not as powerful in its action as the fresh powder. I give the results of the experiments to show that pyrethrum exposed to the air does not deteriorate so rapidly as we would be led to suppose by the statements commonly made concerning the extreme volatility of its essential oil. Although it is always best to get a fresh article and keep it in a closed vessel, pyrethrum that has been long on hand and much exposed is still valuable, and may be improved by thoroughly regrinding. It was also found, by experiment, that pyrethrum freshly mixed in cold water was as effectual in destroying the larvæ of the cabbage worm as when allowed to stand over night or when prepared with boiling water.

KEROSENE EXTRACT OF PYRETHRUM AS AN INSECTICIDE.

In the summer of 1888, while experimenting with various substances for the destruction of the chinch bug, it occurred to me that a combination of kerosene and pyrethrum might form a most powerful insecticide for external applications. The combinations were made by mixing the dry pyrethrum into a previously prepared kerosene emulsion, by using pyrethrum tea instead of pure water to dilute the emulsion, and by extracting the powdered pyrethrum with kerosene and then emulsifying this extract. I have used such an emulsion in comparison with an ordinary kerosene emulsion for the destruction of the Chinch Bug, the False Chinch Bug, *Nysius angustatus*, the Red Spider, plant lice, and cabbage worms, and it has been very uniformly more successful than the latter, but it will be necessary to experiment farther before drawing definite conclusions as to the real value of the compound for the destruction of insects. I referred to my use of these substances in combination in Bulletin 5 of the Iowa Experiment Station, page 184.

In discussing this paper, Mr. C. V. Riley called attention to the fact that Mr. Albert Koebele should have the credit of first using successfully the resin compound in experiments which the former had planned and directed. Mr. Riley also spoke of the varying results reached by different experimenters in the use of kerosene emulsion, and said that he thought these differences were largely due to the manner in which the emulsion was prepared. He said: "In this connection I am tempted to give a prominent illustration of this fact. No one has written more of late years upon the subject than Mr. Cook, and yet from his writings I had become convinced that he had never made a perfect emulsion, as no one following his directions could, as the oil should be

used in twice the quantity of the emulsifying agent to obtain the best results. In a recent pleasant visit to Lansing I drew Mr. Cook's attention to this fact in conjunction with his claim of having first recommended the emulsion in a paper published in the Bulletin of the Michigan State Board of Agriculture for 1878. This paper referred to the mechanical mixture of soapsuds and kerosene used by others years before. Upon Mr. Cook's showing me a vial of this so-called emulsion it confirmed what I have said, in that the oil was entirely separated from the soap."

Mr. Gillette remarked, in confirmation of what was said by Mr. Riley, that he did not know what a kerosene emulsion was until he learned to make it by the Hubbard formula at Ames, Iowa.

Mr. W. B. Alwood said he had spoken of the best method of preparing the emulsion in Bulletin 14 of the Division of Entomology. Mr. Alwood also spoke of kerosene emulsion as a new remedy for the Horn Fly. An emulsion made according to the Hubbard formula, and diluted with 10 parts of water, he found amply strong for the destruction of the flies. Mr. J. B. Smith said he had found a dilution of 1 to 12 to be sufficiently strong for most insects, and 1 to 15 was strong enough for plant lice. For the destruction of scale insects he had found it necessary to use the emulsion as strong as 1 to 10 with water. Mr. Smith said that the mixture should be boiling hot when emulsified, and then if kept in a cool place, free from sudden jars, it would last for a year or more without separating. He had found that a high temperature or sudden jar would cause the oil to separate and rise to the surface.

In regard to the combination of lime and London purple in water mixtures Mr. Smith had found that when thus mixed no arsenic would be deposited on copper, but if no lime was put in the water with the London purple there would be an abundant deposit, showing that the lime actually has the effect to hold the arsenic in an insoluble condition.

Mr. Alwood stated that he had found the kerosene emulsion effectual in destroying plant lice when diluted with 20 or even 25 parts of water.

The next paper was by Mr. C. M. Weed on the life history of *Baris confinis* Lec. Mr. Weed stated that he had found this insect abundant in both the larval and pupa state in the stems of the Spanish needle, *Bidens frondosa*. This paper is to be published elsewhere, and no abstract has been furnished for this report.

The committee adjourned to meet again in the evening.

EVENING SESSION.

The committee was called to order by the chairman, S. A. Forbes. The first paper was by Mr. G. F. Atkinson, on a new root-rot disease of cotton.

A NEW ROOT-ROT DISEASE OF COTTON.

In response to a circular letter issued from the Alabama Agricultural Experiment Station during the early part of the summer of 1890, requesting specimens of cotton affected with the so-called "black rust," "red rust," "root rot," etc., I received specimens of rotted roots of cotton from Saville, Alabama. The specimens were sent by Mr. G. W. Rhodes, of that place, on whose farm they were collected. The disease was called by him "root rot," and the roots were certainly in quite an advanced stage of decay. The two roots sent were taproots and were probably pulled up so that the decayed lateral roots were broken away.

I expected to find the *Ozonium* described by L. H. Pammel as being the cause of a root-rot disease of cotton in Texas. (Bulletins Nos. 4 and 7, Texas Agricultural Experiment Station.) There were no external signs of the mycelium of a fungus visible to the unaided eye, and my examination was made by taking cross-sections.

In all the preparations fungus threads were present, having penetrated the dead tissue. I supposed these were probably connected with the *Ozonium*, though we would expect to find various saprophytic fungi attacking such tissues. In one preparation, however, peculiar fat globules were present in quantity in enlarged cavities. Upon close examination I found also pieces of a thin membrane marked with irregular rugosities and striæ.

This at once suggested to me the presence of the female cysts of *Heterodera radicola*, a root-gall Nematode, which was made the subject of a special study by myself one year ago, and is known to be very injurious to many plants.

The subject now possessed a new interest and I made a special trip to Saville the early part of September to thoroughly investigate the disease and to make careful collections of plants in various stages. Although I possessed the faint suggestions of the presence of *Heterodera* in the material sent me I was quite surprised to find that this worm was the cause of the disease.

There were perhaps 2 or 3 acres in the field that were more or less affected. In some places there were spots several square rods in extent on which the cotton was entirely dead. These spots were often connected by areas more or less affected, and in some places an apparently healthy plant was surrounded by dead ones. The plants I examined were carefully dug up with a shovel. At first I selected those entirely dead. Only a portion of the taproot remained attached to the stem, the lower portion having rotted away. To the plants which had recently died portions of the lateral roots remained in connection, the majority, however, easily breaking away.

In a few cases, even though the roots were well rotted, the characteristic galls could be seen on some of the lateral roots, being oval and somewhat one-sided enlargements. On the decayed taproots no galls

could be found since the tissues were well broken down. A few plants which had been badly diseased showed evidences of partial recovery, young branches growing from the lower part of the stem. Such plants yielded unmistakable evidences of the work of *Heterodera*. While the lower end of the taproot had rotted away the plant had succeeded in putting out a number of roots near the surface of the ground, which had given it the first impetus for growth. These lateral roots possessed an abundance of the galls, and the peculiar cracked and scabby lateral galls in the upper portion of the taproot showed how thoroughly infected the plant had been. But the richest specimens were found in plants which showed the first external signs of the disease. In these specimens not only was there a profuse development of the galls on the lateral roots, but nearly the entire lower portion of the taproot was affected, having large lateral galls, which from age were cracked and scabby in appearance. This is the appearance of the old larger galls on all plants, and lays these parts under contribution to various putrefactive bacteria and saprophytic fungi, so that the roots of many plants literally rot off. The presence of the worm has this effect in the case of the tomato plants that are badly diseased. The taproot is always very freely attacked and rots off below. Tomato plants seldom die outright as a result of the decay of the lower part of the taproot, for they are capable of quickly sending out numerous lateral roots above the point of injury, and thus tide the plant along. Cotton plants do not have the power of sending out lateral roots so readily near the surface of the ground when the stem becomes rather old, and are therefore more liable to serious injury when badly diseased.

Mr. Rhodes was not acquainted with the characteristics of Nematode root-galls and was not aware that any plants in his neighborhood were affected by such a disease. I noticed one old peach tree still in the cotton field, and was informed that a peach orchard occupied the ground about 20 years ago. At my request we visited the garden and upon pulling up tomato and okra plants found them very badly diseased. This was sufficient evidence that portions of the ground there were very badly infected.

The external manifestations of the disease in cotton are strikingly similar to those of the root-rot disease caused by *Ozonium* as described by Pammel, the irregular distribution of the spots as well as the tendency to increase in size and sometimes the changing of the spots. Also, as in the case of *Ozonium*, the first external sign of the disease is the sudden wilting of a plant on a hot, sunshiny day, especially after rain. This similarity in external appearance is easily accounted for from the nature of the disease since the condition of the roots prevents the absorption of water in quantities equal to that transpired by the leaves, though there may be an abundance of water in the soil. From this time the plant rapidly declines.

The diseased plants begin to die about the time of "chopping out"

the cotton in May, when the plants are quite small and the disease continues throughout the season.

In my studies last autumn I found cotton affected at Auburn, but not seriously. Some cotton planted in September of the present year for experimental purposes was, in some cases, seriously attacked while yet only one or two leaves above the cotyledons were developed.

The worms are able to live and develop in the roots of a great variety of plants, though some plants are more subject to serious attack. There are indications that they may become somewhat provincialized in their tastes, in some localities attacking more seriously plants which in other localities are not much injured. If deprived for some time of the food plants they prefer they will affect more seriously the ones which formerly nearly escaped their injuries. That the worm can produce a serious disease of cotton, and is more widely and thoroughly distributed than is generally known, increases the gravity of an already serious question.

Do we know how many nurseries, market gardens, propagating houses, and less pretentious places for growing such plants as the peach, grape, tomato, cabbage, Irish potato, etc., for sale, or even to give away to be transplanted, are infected with this worm? There are certainly some.

If it is within the limits of wise legislation to pass laws to prevent the spread of animal diseases, why not quarantine these centers for the distribution of this Nematode? It seems to me the first and most important action in reference to this enemy of agriculture is to prevent the present reckless policy of distribution, which could easily be done by proper legislation and inspection.

In discussing this paper Mr. Smith spoke of a root disease, probably the work of a Nematode, injuring oats in New Jersey, and supposed by some to be the work of a plant louse. Mr. Atkinson thought this injury to the oats was due to the attacks of a *Tylenchus* sp., and requested all who might find this disease to send him specimens.

Mr. Forbes said that the radishes growing on the university grounds were quite severely attacked by a Nematode, and that specimens could now be obtained from them.

Mr. C. M. Weed then read a paper on the Life Histories of Certain Aphididæ.*

In discussing the paper, Mr. F. M. Webster said he thought in one of the species of *Aphididæ* he had been able to distinguish the oviparous and viviparous females by their positions on the plants, as the latter have the habit of throwing their abdomens out nearly perpendicular to the surface on which they are standing. Mr. Weed had not noticed such a distinction.

Mr. Smith had not found any two species of plant lice with the same

* The substance of this paper is given in the article by Mr. Weed in this number of INSECT LIFE, entitled "Fifth Contribution," etc.

poriferous system, and said it was fully developed only in the winged viviparous forms; he therefore considered reproduction by wingless females examples of true larval reproduction. Mr. Weed did not think so much importance should be placed on wing development. He said that lice born the same day might in some cases become winged and in others not, but all would begin reproducing at the same time.

Mr. Howard stated that the idea just advanced by Mr. Smith as to the larval homology of wingless viviparous females of Aphididæ had been advanced more than once by European writers.

Mr. Smith stated that his point was in proof afforded by the antennæ and not on the general arguments used by others to prove or disprove maturity.

Mr. Forbes said that in his studies of the plant lice he had found that the poriferous system presented good specific characters.

Mr. A. J. Cook had studied very carefully the antennal structure of bees and believes that the differences in the development of their sense organs can be fully accounted for on the theory of the survival of the fittest.

On motion of Mr. Weed the committee extended a cordial invitation to all entomologists present to take an active part in the meeting.

Mr. John Marten then read a paper reporting the results of observations and experiments upon the Hessian fly, made at the office of the Illinois State Entomologist during the year 1890, after which the committee adjourned to 10 a. m., November 12.

NEW NOTES ON THE LIFE HISTORY OF THE HESSIAN FLY.

By JNO. MARTEN.

[Author's abstract.]

From 1,000 "flaxseeds" collected March 13 and placed in large insectary breeding cages stocked with wheat, imagos emerged from March 31 to May 1, the greater number about the middle of April. From these were derived larvæ and "flaxseeds" in growing wheat by the 9th of May, males and females of this *second spring brood* appearing from May 28 to June 14. These insectary experiments were confirmed by field observations carried on as a check. Both in the field and in the laboratory the tillers of the wheat were much more heavily infested than the original stalk.

Out-of door cages of wheat were stocked June 20 with "flaxseeds" from the above-mentioned second spring brood, but yielded nothing until September 19, when imagos began to appear. This experiment, paralleled also by field observations, was held to demonstrate æstivation of the insect in the puparium.

Careful experiments made to test the susceptibility of timothy, blue grass, red top, foxtail, and orchard grass to injury by the Hessian Fly, gave only negative results.

The breeding-cage methods were described as follows :

Cages 2 by 3 by 3 feet were built of light wooden frames covered with Swiss. They were left open at the bottom, and a door sufficiently large to admit of an insect net's passing through it was made on one side. These cages were placed over growing wheat and the lower edges of the frames sunk into the soil sufficiently to prevent communication between the inside and outside. At first the cages were placed inside the insectary, over wheat either sown or transplanted from the field.

"Flaxseeds" to be placed among the wheat in these cages were at first removed from the wheat in which they grew; later they were left in the stalks, with seemingly better results. The wheat was watered frequently by means of a hose with a spray nozzle, and grew well, except in one cage, which was shaded by a wall and suffered from fungus attack.

Great care was taken to keep the broods separate. As soon as imagoes ceased emerging for a few days all remaining unchanged puparia, etc., were removed, that there might be no confusion.

After the cages were removed out of doors they were stocked with puparia, and a constant growth of wheat was kept in them by transplanting and by sowing wheat in them, so that had the midsummer flies appeared at any time they would have found a place in which to oviposit. As the season was dry, only sufficient water was used to prevent the wheat's dying. Material in the cages was disturbed as little as possible in noting its condition.

CHAMPAIGN, ILLINOIS, *November 12, 1890.*

The meeting was called to order by Chairman S. A. Forbes. The minutes of the previous meeting were read and approved.

On motion of Mr. J. B. Smith a subcommittee of three was appointed by the chair to confer with the committee on coöperation of the Association of Economic Entomologists for the purpose of recommending means of getting more time and liberty allowed us in which to hold our meetings and increase our membership, if possible, in the future. Messrs. J. B. Smith, C. M. Weed, and H. Garman were appointed upon this subcommittee.

Mr. Woodworth read the following paper :

THE LABORATORY METHOD OF EXPERIMENTATION.*

By C. W. WOODWORTH.

The work of Harris, Fitch, and Walsh and many of our own day is chiefly along the line of simple observation, but there is opening a new era for economic entomology, for we as Experiment Station officers are or should be especially concerned with experimentation. This will soon come to be recognized as the only means for laying a sure foundation for the science of economic entomology.

*This paper was illustrated by large diagrams, which can not be introduced here.

Two methods of experimentation may be distinguished. One we may call the field method and the other the laboratory method. The first method is exemplified in the splendid sets of experiments conducted by the United States Division of Entomology. They are to test practical questions by practical methods; that is, they take the conditions as they occur in nature and apply remedies with methods by which they could be applied in practical work. The laboratory method may produce conditions that seldom or never occur in nature, and may use remedies by methods entirely impractical in the field. It is essential to the field method that we take things as they are; that we do everything in a rough way. The laboratory method, on the other hand, is especially characterized by the greatest possible accuracy in its detail and by the elimination as far as possible of all sources of error. The results obtained by the former method are practical, but almost wholly empirical, while the latter gives theoretical information. Both methods are valuable, both are essential to economic entomology. The field method heretofore has been chiefly followed, so that the practice, though often of a very doubtful character, is far in advance of the theoretical knowledge of this science. It is to call your attention to the value and importance of the laboratory method that this paper is prepared.

That part of the therapeutics of economic entomology that deals with the effects the insecticides have on plants is deservedly receiving considerable attention. The arsenites are the most important insecticides from this point of view, both on account of their extensive use and because of the great injury to the plants for which they are sometimes accountable.

The injury they do to vegetable tissue seems to depend to a great extent upon their absorption by the plant. The critical points are the time of application [when the poison is applied wet] and each subsequent rain or dew. A knowledge therefore of the conditions favoring rapid absorption is of great importance. Some experiments made by us on oak leaves prove that the leaf in drying increases its power to absorb water up to a certain point and then decreases it. Is this the case with other plants? If so, the best time to spray on a clear day is in the afternoon, but on a less clear one, in the morning. There is need of a large amount of experimentation along this line.

In making applications of the insecticides to the leaf to determine the injury produced it is essential that we be enabled to make a uniform application, that is to apply the same amount of poison each time. The use of water as a dilutant seems more accurate than if the poison is used in the dry way, and dipping is the mode of application which in my hands has been most satisfactory.

To compare different insecticides it is essential that we make our solutions of some standard strength. Unquestionably the standard for comparison should be their effectiveness in killing insects. This will

differ for different insects, and perhaps the insecticides will even have a different ratio. Therefore the standard for experiment must be made arbitrarily and calculated to the comparison standard for each insect. The past season we have made the experiment standard for our work approximately the amount of arsenic in the insecticides. Next season we intend to use the same standard, but first have the substance analyzed and make our mixtures as accurately as possible. In preparing for a set of experiments we have invariably made but one strength of the poison and obtained the other strengths by dilution, both for the sake of speed and accuracy.

Not only must the strength of the mixture be brought to a standard, but the method of its preparation must be uniform. The addition of any substance, as lime, may entirely change the nature of the mixture, and if water from different sources be used, it must be proven by experiment that no variation in the results is produced. The length of time after the preparation is made has a great influence. As tested on sorghum leaves, London purple is but little if any changed by standing, while Paris green becomes fully twice as injurious and the injury from white arsenic is increased perhaps a hundred fold. The Paris green mixture used on the oak, even when fresh, is more injurious than London purple, a fact hard to account for.

There is so much difference in the action of the poison on different leaves that it is necessary to carefully select leaves that are uniform for experimental purposes. I believe that individual leaves are most desirable for several reasons. Among the things that are proven to cause variation in the results are, age, physical condition, and exposure. Uniformity in these conditions at least must be secured when experiments are to be compared.

For marking the leaves, I have tried a number of methods. Tags attached by fine wire are quite quickly applied, but injure the petioles of some plants. Tying is a rather tedious operation, but without other objections. A faster way is the use of artist's oil paints, putting a mark or number on the leaf. I think that a set of conductor's punches would make the quickest and most satisfactory mark.

A most important thing is the reading of the results of the experiments. Figures are for all reasons better than the use of such terms as much and little. My plan is to read in tenths. I find I can do this very uniformly. It is my habit to occasionally test myself by rereading sets of experiments. With a higher number, as twenty, I can not read satisfactorily. Ten is a most convenient number for calculations.

It is best to take more than one reading, perhaps as often as daily, and to trace the injury carefully. This will enable one to note exceptional leaves and perhaps discover the cause. The difference observable between early and late reading suggests the possibility of arresting injury by a thorough washing with water, or better, by applying water containing iron rust, and would not the use of the latter remove the objections to the use of the arsenic on fruits?

There is more than one kind of injury produced by arsenites. One form generally shows itself as a spotting of the leaf. It is this form that is usually observed and written about, but on certain plants it is doubtful if the most injury be not produced in another way which I have denominated chronic poisoning. This does not show itself immediately according to my experience, but unless the leaf has also acute local poisoning there is for some time no effect observable. Later the leaf passes through the same process as is normal later in the year, becoming dryer, generally coloring red or yellow and dropping. In the summer or fall, after the spring growth has ceased, the limbs to which an application is made will sometimes be left entirely bare from this cause, while the other parts of the tree retain their foliage. Chronic poisoning is most severe on peach of any plant with which I have experimented, apple perhaps being the next. A similar thing occurs in the use of the alkalis.

Cross-section paper is a great requisite when this kind of experimentation is conducted. Each reading should be plotted so as to give the investigator a clear idea of his results. Any deviation from a regular curve, any exceptional maximum or minimum reading should be investigated, for it is only by attention to such details that we can be able to find the cause of variation and to eliminate in subsequent experiments that source of error. In reporting the experiments, the detailed figures will be of little value, but the averages, the number of experiments, and the maximum and minimum readings will give one an idea not only of the results, but also of the trustworthiness of the work.

Such experimentation as I have outlined presents a promising field for coöperative work, and, as before stated, it is this kind of experimentation that is at present most needed. We must have a theoretical knowledge of the subject, a rational for our practice; for with economic entomology, as with any other science, all investigation is hindered and of a more or less transient value until the fundamental principles are well established.

Mr. Beckwith then read the following paper :

PRACTICAL NOTES ON THE USE OF INSECTICIDES.

By M. H. BECKWITH.

So much has already been written concerning this subject that it would seem to be scarcely worth while to attempt to add anything that will be of value. Although I may not be able to give you any new method of using insecticides, the work in this line that I have been able to accomplish during the past season may prove interesting.

It is not always those experiments that are the most successful that prove most valuable. Frequently it is our failures that finally produce the best results. Thus it is with the use of insecticides; in attempting to prevent the ravages of certain insects by the method that appears

at the time the most feasible, we find that it is entirely impracticable and at once proceed to accomplish the desired result by some other means until a method is found that proves to be a complete success. The complete failure of the first method, while it may be very discouraging, puts us on our metal to discover something that will prove effectual; whereas if a partial success had been secured in the first instance, we would in all probability have been content to rest on our laurels and have adopted that method as the best one available; at least such has been my experience during the past season.

Early in the spring a letter was received from Col. J. J. Ross, an extensive fruit grower residing in the vicinity of Seaford, Delaware, stating that the peach trees in his young orchard were being destroyed by the Aphis, and requesting me to visit his place and see what could be done to destroy the insects. Upon arriving there I found a large number of the trees literally covered with the species now known as *Aphis persicae-niger*, the name and description having since been published by Dr. Erwin F. Smith, in *Entomologica Americana*. These Aphids may be found in an infested orchard at all seasons of the year, located either upon the roots or upon the limbs and twigs of the trees.

The trees were from 4 to 5 feet in height and the leaves upon many of them were already withered, and in some instances entirely destroyed. I began spraying the trees in the afternoon with kerosene emulsion in proportion of 1 part to 15 parts of water, using the Nixon Little Giant spraying machine and Nixon nozzle. An examination of the sprayed trees the next morning gave such assurance of the effectiveness of the treatment that Colonel Ross immediately ordered one of the Lockport machines by telegraph. After showing method of preparing the emulsion, I returned to the Experiment Station to attend to other work. Subsequent sprayings under Colonel Ross's direction he informed me did not succeed in destroying the Aphids. Whether the failure was due to faulty preparation of the emulsion or the lack of thoroughness in the application, I am unable to say.

Upon hearing of this failure, I at once sprayed with the emulsion several badly infested trees in an orchard near Dover, and upon examining twigs from the sprayed trees about 20 hours after treatment, by actual count I found that 80 per cent. of the Aphids had been destroyed by a single treatment. Upon my recommendation, Dr. Hugh Martin used the kerosene emulsion upon infested trees in his orchard near Bridgeville and one application resulted in entirely freeing the trees from the insects.

I advised several other parties to use a decoction of tobacco and water. Mr. E. G. Packard, of Dover, Delaware, took 5 pounds of tobacco stems and steeped them in 3 gallons of water for 3 hours. After straining the decoction, he added sufficient water to make 7 gallons. This amount was sufficient to spray two hundred two-years-old peach trees that were badly infested with the Aphids. One treatment proved effectual.

From my experience I am confident that either the kerosene emulsion or the tobacco decoction will prove a certain remedy for the Black Aphid of the peach tree if thoroughly applied in the form of a strong, fine spray while the insects are above the surface of the soil.

The Rose Chafer, or Rose-bug, as it is commonly known with us, *Macrodactylus subspinosus*, is one of our most troublesome insect pests. It usually makes its appearance about the 24th of May; I captured a few specimens this season on the 22d. In sections where the Stagger-bush, or Kill Deer, *Andromeda* sp., is abundant, the Rose Chafer feeds upon the fragrant blossoms of this plant as long as a flower remains in preference to anything else; when these are gone, it attacks the blossom buds of the grape and in a very short time will destroy every bunch of buds in a vineyard and frequently the leaves also.

They do not stop with the grape vines, but attack and destroy the fruit of the Apple, Peach, Pear, and, in the case of the Plum and Cherry, both fruit and leaves. They are also very partial to the young, green Walnuts upon the trees of *Juglans nigra*.

My first experience with this insect was in the vineyard of Mr. E. H. Brancroft near Camden, Delaware—the finest and best kept vineyard that I have seen in Delaware. There were six hundred Concord grape vines, planted 8 feet apart with a post about $6\frac{1}{2}$ feet high at each vine, and with single wires at the top of the posts extending in both directions and crossing each other at right angles upon which the vines were trained.

When I began work in this vineyard the beetles had just commenced feeding upon the blossom buds. At first I hung small vials containing bisulphide of carbon among the vines, to test the effect of the odor in keeping the insects away from the vines, but soon found that it would not prove effectual.

I sprayed a portion of the vineyard with London purple at the rate of 1 pound of London purple to 200 gallons of water, thoroughly drenching the vines until the liquid dripped from them. A thorough examination of the treated vines about 12 hours afterward fully convinced me that the treatment was entirely useless. Not a dead Rose-bug could be found. In feeding upon the blossom buds the Rose-bugs merely bite through the outer covering of the buds and then feed upon the inner parts. Finally I sprayed several rows with a thin whitewash, completely covering the foliage with a coating of lime. At first this appeared distasteful to the insects, and I began to think that it would succeed in preventing their ravages; but after a few hours it was evident that they were feeding in that part of the vineyard in as great numbers as upon the untreated portion.

By this time I found that nearly every cluster of blossom buds upon the vines was destroyed, and having devoted the greater part of two days to the experiment, I returned to the station almost completely discouraged.

The next morning a lady residing near Newark informed me that the Rose Chafers were destroying her roses. I made up my mind that I would not give up the fight without at least another effort, and, preparing a supply of kerosene emulsion, gave the rose bushes a thorough spraying, using at the rate of one part of emulsion to nine parts of water. As soon as the spray struck the insects many of them released their hold and fell to the ground. The application was made just at evening, and the next day I found many dead insects upon the ground underneath the bushes. There were numerous Rose Chafers upon the roses at this time, but to all appearance they had come upon them after the application of the emulsion. The same evening I applied the emulsion upon some infested rose bushes in my own garden, and afterwards picked a number of the roses upon which were a large number of the insects and placed them in a well-ventilated breeding cage. The next morning every bug was found to have been killed by the treatment. Of course the treatment would probably have to be repeated every day for some days in order to destroy the insects that had just hatched out or had come from some other feeding ground.

From my experience with the Rose Chafer I feel very confident that it can be controlled by the use of the kerosene emulsion. I have planned for the coming season an experiment to compare the efficacy of the emulsion and the new insecticide Zomonia.

Several persons have informed me that they have noticed large numbers of dead Rose Chafers upon the ground under Ailanthus and Linden trees when the trees were in full bloom. From this fact they concluded that there was something about the blossoms that poisoned the insects. I thought it possible that the Ailanthus blossom might contain something that would prove valuable as an insecticide; but knowing that the Linden was the source of our finest honey, I was somewhat puzzled to account for the death of the insects. After carefully watching an Ailanthus tree that was located near the college campus, I found that the blossoms were frequented by large numbers of insects of different species, the most numerous of which were the soldier beetles, *Chauliognathus pennsylvanicus*, none of which were injuriously affected.

After considerable study, I arrived at the conclusion that the Rose Chafers were attracted by the blossoms and fed upon them until the females were ready to enter the soil to deposit their eggs, and the males, dying a natural death, dropped from the trees. Unfortunately I did not have the opportunity to visit Ailanthus trees while in bloom in localities where the insects were abundant, and consequently was unable to verify my conclusion.

My work the past season with remedies for the Codling Moth has been confined to a comparison of the efficacy of London purple and Paris green. The experiment was conducted in a large apple orchard belonging to the Randolph Peter's Nursery Company, located about 2

miles from the Experiment Station. The only variety available for the purpose was the Early Harvest, nearly all the fruit of other varieties having been destroyed by frost and cold, wet weather. The fruit upon a number of the sprayed trees was destroyed, and the plan of the experiment was in consequence somewhat disarranged.

The Nixon Little Giant spraying machine and the No. 3 Nixon nozzle were used in spraying the trees. Instead of attaching a pole to the hose, a section of three-eighths inch iron gas-pipe 10 feet long was connected with it and the nozzle screwed upon the end of the iron pipe. I find that it is much more convenient than a pole, and at the same time every part of the tree can be reached with the spray.

Six rows of trees were selected, and each row was given a different treatment. Three rows were treated with London purple and three with Paris green. The first row in each case was sprayed with water containing the insecticide in the proportion of 1 pound to 200 gallons of water, the second 1 pound to 300 gallons, and the third 1 pound to 400 gallons. A portion of the trees in each row was treated at two different dates, May 16 and 31. Another portion was treated at the same time, and again on June 14. Still another portion was treated May 31 and June 14.

The fruit was picked from the trees July 8, 9, and 10. Each apple was carefully examined and the percentage of the yield containing Codling larvæ and recorded as wormy was as follows:

Two trees sprayed May 16 and 31, at the rate of 1 pound of London purple to 200 gallons of water, produced 2,618 apples, of which 272 or 9.7 per cent. were wormy.

The two trees sprayed with Paris green at the same rate produced 3,120 apples, of which 149 or 4.5 per cent. were wormy; or 5.2 per cent. less wormy fruit from the trees sprayed with Paris green.

Two trees sprayed May 16 and 31 at the rate of 1 pound London purple to 300 gallons of water produced 170 apples, of which 21 or 15.1 per cent. were wormy, and two trees sprayed with Paris green at the same rate produced 740 apples, of which 28 or 7 per cent. were wormy; a difference of 8.1 per cent. in favor of Paris green.

Two trees sprayed May 16 and 31 at the rate of 1 pound of London purple to 400 gallons of water produced 189 apples, of which 23 or 12.1 per cent. were wormy.

One tree sprayed with Paris green at the same rate produced 732 apples, of which 45 or 6.1 per cent. were wormy; a difference of 6 per cent. in favor of Paris green.

Combining the above treatments of each insecticide, we find that 12.3 per cent. of the total yield of the six trees treated with London purple were infested with the Codling larva, and only 5.8 per cent. of the total yield of the five trees treated with Paris green were infested, giving 6.5 per cent. less wormy fruit from trees receiving the Paris green treatment.

Comparing the trees that received three sprayings on May 16, 31, and June 14, we find that two trees treated with London purple at the rate of 1 pound to 200 gallons of water produced 1,615 apples, 27 of which, or 1.4 per cent of the yield, were wormy. The three trees treated with Paris green at the same time and in the same proportion produced 2,035 apples of which 36, or 1.5 per cent of the yield, were wormy. In this case we have one-tenth of 1 per cent less wormy fruit from trees treated with London purple—practically no difference.

Three trees that were treated with London purple at the rate of 1 pound to 300 gallons of water produced 1,057 apples, 31, or 6.5 per cent, of which were wormy, and three trees treated with Paris green at the same rate produced 2,852 apples, 97 of which, or only 4.6 per cent of the yield, were wormy; thus showing 1.9 per cent less wormy fruit from the trees treated with Paris green.

In comparing the fruit from the trees treated at the rate of 1 pound to 400 gallons of water, we find that the two trees treated with London purple produced 806 apples, 39 of which, or 4.5 per cent, were wormy; and that two trees treated with Paris green produced 4,204 apples, 58 of which, or only 1.2 per cent, were wormy; a difference of 3.3 per cent in favor of Paris green treatment.

Combining the treatment of each insecticide, we have 4.1 per cent of the yield of the trees treated with London purple that are wormy, and only 2.6 per cent from trees treated with Paris green; a difference of 1.5 per cent in favor of the Paris green.

Comparing the fruit from trees treated May 31 and June 14, we obtain the following data:

The two trees treated with London purple at the rate of 1 pound to 200 gallons of water produced so little fruit that no record of the yield was kept. Two trees treated with Paris green produced 464 apples, 53 of which, or 11.3 per cent, were wormy.

One tree treated with London purple at the rate of 1 pound to 300 gallons of water produced 985 apples, 58 of which, or 5.8 per cent, were wormy. Two trees treated with Paris green in the same proportion produced 1,646 apples, 70 of which, or 5.2 per cent, were wormy; a difference of six-tenths of 1 per cent in favor of the Paris green.

Two trees treated with London purple at the rate of 1 pound to 400 gallons of water produced 847 apples, 40 of which, or 5.3 per cent, were wormy, and one tree treated with Paris green at the same rate produced 985 apples, 58 of which, or 5.9 per cent, were wormy; a difference of six-tenths of 1 per cent in favor of London purple.

Comparing the several treatments of London purple and Paris green we find that 5.5 per cent of the yield of the three trees treated with London purple were wormy, and 7.4 per cent of the yield of the five trees treated with Paris green were wormy; a difference of 1.9 per cent in favor of London purple.

The apples from two trees that were not treated were counted and examined with the following results:

One produced 846 apples, 297 of which, or 35.1 per cent, were wormy, and the other produced 751 apples, 278 of which, or 37 per cent, were wormy.

Summarizing the results of the experiment, we find that the foliage of the trees was entirely uninjured by any of the treatments; that in nine comparisons of the treatments of London purple and Paris green seven resulted in favor of using Paris green. The two treatments gave in one instance only one-tenth of 1 per cent and in the other six-tenths of 1 per cent in favor of London purple; that in every instance except one the use of insecticides at the rate of 1 pound to 200 gallons of water gave the best results.

That 7.6 per cent of the fruit from all trees sprayed with London purple was infested with the codling larva, and only 4.4 per cent from those sprayed with Paris green; a difference of 3.2 per cent in favor of the latter.

I deem it unnecessary to enlarge upon the utility of the treatments, as it is generally conceded that the ravages of the codling larva can be prevented. Heretofore I have been prejudiced in favor of London purple, but this experiment proves conclusively that Paris green is the more effectual.

The next paper was by Mr. C. M. Weed:

LIFE HISTORY OF PIMPLA INQUISITOR.

By C. M. WEED.

[Author's abstract.]

The author reported rearing this species from larvæ externally parasitic on an unknown Lepidopterous larva living within the stems of Evening Primrose (*Oenothera biennis*). Figures of all stages of the parasite were shown.* The eggs had been found several times attached to dead lepidopterous larvæ, suggesting the surmise that these larvæ were stung by the adult *Pimpla* before oviposition.

In the discussion of this paper Mr. F. L. Harvey inquired if *Pimpla* species oviposit in larvæ already dead. Mr. Weed said that it was possible that they did, but he did not know.

Mr. Howard asked how many eggs Mr. Weed found on a single larva, to which Mr. Weed replied that he usually found but one, but occasionally two.

* Dr. Weed has submitted a specimen of this larva, which proves to be *Laverna eloisella* Clem, the only Lepidopteron which we know to breed in the stems of *Oenothera*, the and which we reared many years ago at St. Louis. Of the other species of same genus affecting *Oenothera* and which Miss Murtfeldt has reared for us, *L. murtfeldtiella* Ch. feeds in the flower buds; and *L. brevitella* Clem and *L. circumscriptiella* Zeller, in the seed capsules.—C. V. R.

Mr. Howard said that the fact that *Pimpla inquisitor*, ordinarily an internal feeder, becomes here external, is an interesting confirmation of a generalization recently made by Professor Riley, to the effect that nearly all parasites of endophytic insects are external.

Mr. Riley remarked, in view of what had just been said, that this generalization would hold good not only in reference to endophytic larvæ but also in reference to many external feeders, especially such as in transforming spin a cocoon. He had shown that *Thalessa* fed externally, the egg being probably laid on or near the *Tremex* larva. The *Ophion* larva was known to feed externally, the egg being strongly fastened to the skin of the victim. The same was true of most of the Digger wasps so far as his observations went, and particularly in the *Scoliidae*, *Pompilidae*, *Sphecidae*, and *Bembecidae*. In some cases of external parasites the egg of the parent would seem to be necessarily laid in the burrow of the plant-feeder, the young larva being obliged to find its victim, but in most cases the egg was attached by the parent.

Mr. Aldrich showed specimens of *Opheltes glaucopterus* that he had bred from larvæ of *Cimbex americana*. He also stated that it had been bred from *C. americana* by Mr. O. Lugger, of Minnesota.

Mr. Howard stated that this same species is a common parasite in Europe on *Cimbex* larvæ.

Mr. James Fletcher said he had bred the same insect in Canada.
Adjourned until evening.

EVENING SESSION.

After being called to order by Chairman S. A. Forbes, the following officers were elected for the ensuing year: Chairman, Mr. A. J. Cook; secretary, Mr. C. P. Gillette.

The subcommittee appointed to confer with the committee on coöperation of the Association of Official Economic Entomologists then made its report through its chairman, Mr. J. B. Smith. After making certain amendments the report was adopted as follows: The committee on entomology respectfully begs to state to the general association that the papers presented by its members have been of such general interest to the station workers and teachers and that so much advantage has resulted to individuals, all of which will redound to the benefit of the stations and colleges, that they are encouraged to ask that, if possible, the programs be so arranged hereafter that more time shall be given for the consideration of special topics by the permanent committees.

Mr. C. Woodworth moved that one member of the committee be appointed to act conjointly with two other persons, one from the permanent committee on botany and one from the permanent committee on horticulture, to secure, if possible, a set of standard, uniform connections for nozzles and pipe fixtures used in spraying machinery. Mr. Alwood was appointed by the chair to act in this capacity.

On motion of Mr. A. J. Cook the committee decided that in the cir-

culars sent out to call the next annual meeting a cordial invitation should be extended to any not members to be present and take part in the meetings.

Mr. Howard then read the following paper:

THE HOST RELATIONS OF PARASITIC HYMENOPTERA.

By L. O. HOWARD.

So many instances of the importance of the Hymenopterous parasites of injurious insects are on record that there is no necessity of dwelling upon it before a meeting of working entomologists.

They are of greatly more importance to us than Dipterous parasites not only on account of their vastly superior numbers, but in the extremely important point of rapid breeding. Had *Lestophonus*, the Australian Dipterous parasite of *Icerya purchasi*, which Professor Riley sent Mr. Koebele to Australia to bring over alive, been a Hymenopterous parasite like *Euplectrus*, for example, which Schwarz has shown may occupy in the Southern States in summer the almost incredibly short time of 8 days for a single generation, there would have been no necessity for the now famous *Vedalia cardinalis*, as even this rapid breeder occupies 30 days in its life round, even under the most favorable circumstances.

With this advantage over Dipterous parasites, as well as over predaceous insects, they have still another over the latter class of beneficial insects, in that they are never cannibals, a habit which is often a serious drawback to the otherwise fair characters of many predaceous species.

The importance of their work admitted, the importance of their study follows as a necessary corollary, and perhaps the most important feature of the results of such study is the attainment of that knowledge which will enable us to recognize the limitations of each parasitic species; given a certain parasite, to know upon what it is liable to prey, or, given a certain injurious insect, to know what parasites will probably attack it. More precise knowledge will be gained when our rearings will enable us to bring forth an accessible volume in which we may see at a glance just what parasites have been reared from a certain injurious species, just what species have been reared from congeneric forms, and, by a converse arrangement, just what hosts a certain parasite possesses. Grouping such facts will enable the most important generalizations and systematic classification will undoubtedly be affected.

Our published knowledge in these directions is so far slight in this country, nor have the isolated records and shorter lists been brought together in Europe. Some 4 years ago I began, as a basis for generalization as to the habits of restricted groups, the lumping of the European lists by means of a card catalogue. The task proved a much greater one than I anticipated, and later Dr. Riley kindly afforded me

assistance through some of the clerks of the Division of Entomology at odd moments. I have now accumulated about 20,000 cards, each one referring to a recorded rearing of a hymenopterous parasite in Europe. I am now engaged upon the work of arranging these cards according to the latest accepted classification of the host insects, and it proves a task of equal magnitude to the original preparation of the cards, but already I can see unsuspected generalizations ahead, and already I feel myself much better acquainted with group habits. I have been able to draw up a short table of the American and European parasites of insects common to both continents, and in the case of several recently imported pests have been able to tabulate at once and without search of the literature lists of the European parasites, thus indicating the best species for importation, and also showing which of our own forms will be most likely to attack the newcomer.

When it comes to the host relations of our own parasites, however—and this, for our purposes, as constant students of insects in the breeding cage, is by far the most important side of the work—the poor showing which we make is most deplorable. In 1885 I published a short list of about 60 rearings of Chalcidids, in 1889 a compiled list of less than 100 rearings and in the same year a list of 116 rearings of butterfly parasites. During the present year the editors of *INSECT LIFE* have been publishing the rearings of Hymenopterous parasites indicated in the notes and collections of the Division of Entomology and National Museum, largely from Professor Riley's earlier notes, and have recorded some 300 rearings of Braconidæ and have ready for publication about 300 of the family Ichneumonidæ. Lists of rearings in the Chalcididæ Proctotrupidæ and in the parasitic Cynipidæ which will follow will be much shorter, not from lack of material, but from the incompleteness with which the collections in these families are determined.

As to the scattered records, in the reports of economic entomologists and in our entomological journals, most of you would probably be surprised, as I have been, at the extremely small size of a list based upon such records. It will certainly not equal in size the short combined lists already published, so that altogether from published records we shall have a total of less than 1,500 American rearings. This as against 20,000, which I estimate for European records, is such an unfavorable contrast that I am anxious to improve it greatly before publishing, and I am satisfied that this can be done by enlisting the active coöperation of the members of this association.

What I would urge you to do is this: (1) prepare and publish lists of your rearings of such parasites as you have named in your collections; (2) if you have neither the time nor the facilities for naming the unnamed species send them to Professor Riley at Washington, and I have his authority for the promise that he will name them or have them named by comparison with the National collection. (In such case send duplicates, when possible, which need not be returned; but if necessary

the specimens will be sent back). If you do not care to take the trouble to list such rearings, if you will send breeding memoranda with the specimens, we will have them listed for you and then, if you desire, will publish them in *INSECT LIFE*. (3) Pay as much attention as possible to this matter of parasites, and save carefully everything reared.

If this course is followed for say two or three seasons, I feel satisfied that a most creditable and extremely valuable compilation can be made, which I am confident will be one of the works most often referred to by the working economic entomologist.

Mr. Snow then presented the following :

EXPERIMENTS FOR THE DESTRUCTION OF CHINCH BUGS IN THE FIELD BY THE ARTIFICIAL INTRODUCTION OF CONTAGIOUS DISEASES.

By F. H. SNOW.

These experiments have been continued through the two seasons of 1889 and 1890, and have been remarkably successful. As Entomologist to the Kansas State Board of Agriculture I had prepared an article for the annual meeting of that Board in January, 1889, stating what was known at that time upon the subject, and calling attention to the investigations of Professors Forbes, Burrill, and Lugger. In June, 1889, a letter was received from Dr. J. T. Curtiss, of Dwight, Morris County, Kansas, announcing that one of the diseases mentioned in the article (*Entomophthora*) was raging in various fields in that region, and stating that in many places in fields of oats and wheat the ground was fairly white with the dead bugs. Some of these dead bugs were at once obtained and experiments were begun in the entomological laboratory of the university. It was found that living, healthy bugs, when placed in the same jar with the dead bugs from Morris County were sickened and killed within 10 days. A Lawrence newspaper reporter, learning of this fact, published the statement that any farmers who were troubled by chinch bugs might easily destroy them from their entire farms by sending to me for some diseased bugs. This announcement was published all over the country, and in a few days I received applications from Agricultural Experiment Stations and farmers in nine different States, praying for a few "diseased and deceased" bugs with which to inoculate the destroying pests with a fatal disease. Some fifty packages were sent out during the season of 1889, and the results were in the main highly favorable.

It was my belief that sick bugs would prove more serviceable in the dissemination of disease than dead bugs. I accordingly sent out a circular letter with each package, instructing the receiver to place the dead bugs in a jar for 48 hours, with from ten to twenty times as many live bugs from the field. In this way the disease would be communicated to the live bugs in the jar. These sick bugs being deposited in

different portions of the field of experiment would communicate the disease more thoroughly while moving about among the healthy bugs by which they would be surrounded. This belief was corroborated by the results. The disease was successfully introduced from my laboratory into the States of Missouri, Nebraska, Indiana, Ohio, and Minnesota, and into various counties in the State of Kansas. A report of my observations and experiments in 1889 has been published in the Transactions of the Kansas Academy of Science, vol. XII, pp. 34-37, also in the Report of the Proceedings of the Annual Meeting of the Kansas State Board of Agriculture in January, 1890.

The next point to be attained was the preservation of the disease through the winter in order that it might be under my control and be available for use in the season of 1890. To accomplish this result, I placed fresh, healthy bugs in the infection jar late in November, 1889, and was pleased to note that they contracted the disease and died in the same way as in the earlier part of the season. I was not able to obtain fresh material for the purpose of testing the vitality of the disease germs in the spring of 1890 until the month of April, and then only a limited supply of live bugs could be secured. I quote the following from my laboratory notes :

April 10, twenty-five chinch bugs that had hibernated in the field were put in the infection jars. They were supplied with young wheat plants. The bugs appeared lively and healthy.

April 16, some of the bugs were dead and all appeared stupid.

April 20, all of the bugs were dead.

One week later a new supply of fourteen bugs was put into the jar ; they were supplied with growing wheat. They ran substantially the same course as the first twenty-five. Some had died at the end first week and all were dead by the end of the thirteenth day.

The chinch bug seemed to have been very generally exterminated in Kansas in 1889 and only three applications for diseased bugs were received in 1890 up to the middle of July. On account of the limited amount of infection material on hand I required each applicant to send me a box of live bugs, which I placed in the infection jars, returning in a few days a portion of the sick bugs to the sender. The three applicants above noted reported the complete success of the experiments. I give the following letter from Mr. M. F. Mattocks, of Wauneta, Chautauqua County, Kansas :

WAUNETA, KANSAS, *July 7, 1890.*

Professor SNOW, *Lawrence, Kansas :*

DEAR SIR : I received from you a few days since a box of diseased chinch bugs. I treated them according to instructions, and I have watched them closely and find that they have conveyed the disease almost all over my farm, and the bugs are dying at a rapid rate. I have not found any dead bugs on farms adjoining me. I here inclose you box of healthy bugs that I gathered $1\frac{1}{2}$ miles from my place. I do not think they are diseased.

Yours,

M. F. MATTOCKS.

I also quote the following clipping from the Cedarvale Star:

INFECTING CHINCH BUGS.

There is no longer any need of having our crops destroyed by chinch bugs. A remedy that is sure as death and that costs nothing has been discovered and is used in this country with complete success. Mr. M. F. Mattocks, living a mile and a half east of Wauneta, on the H. P. Moser farm, is entitled to the credit of demonstrating in this part the efficiency of the remedy. He was about to lose his corn crop by the bugs that were swarming into it from the stubble. He sent to Chancellor F. H. Snow, of the State University at Lawrence, and from him received a box containing a half dozen diseased bugs. With them he exterminated a 40-acre field full of the pests. They have died by the millions; in fact, they have about all died from the infection of those six bugs. A little circular of instructions, which he followed out, came with them. The six bugs were placed in a bottle with three or four hundred from the field, and were left together 36 hours and then turned loose, both the living ones and the dead, in the field. Devastation followed, and Mr. Mattocks will be troubled no more with chinch bugs this year. If your crop is in danger you can save it by the same means of getting the diseased bugs in your field. It will cost you nothing, and is a dead sure remedy. He has been sending dead and infected bugs to others in the country and to Professor Snow, whose supply was running down.

I personally visited Mr. Mattock's farm and verified the above statements.

The difficulty of obtaining enough live bugs to experiment with in the laboratory led to the sending out of the following advertisement, which was forwarded to twenty prominent papers on August 14, with requests for its publication:

WANTED! CHINCH BUGS!

Prof. F. H. Snow, of the University of Kansas, is in great need of some live and healthy chinch bugs with which to carry on his experiments in chinch-bug infection. Anyone who will send a small lot of bugs to Professor Snow, University of Kansas, Lawrence, Kansas, will confer a favor on the investigator, and, it is hoped, on the farmers of Kansas.

This request for live bugs was given wide circulation and resulted in keeping the laboratory fairly well supplied with material for experiment.

Before the close of the season of 1890 it became evident that there were at least three diseases at work in our infection jars, the "white fungus" (*Entomophthora* or *Empusa*), a bacterial disease (*Micrococcus*), and a fungus considered by Dr. Roland Thaxter to be *Isaria*, or perhaps more properly *Trichoderma*.

The following report which describes the bugs as "collecting in clusters" points to the bacterial disease as the cause of destruction in the field:

PIGUA, KANSAS, July 12, 1890.

DEAR SIR: Since writing you from Humboldt, Kansas, the 6th instant, I have made the happy discovery that the germs of *contagious disease* sent me were vital. On Sunday last upon examination of the millet field I found *millions of dead bugs*. They were collected in clusters. My idea is that dampness facilitates the spread of the contagion. The first distribution of diseased bugs 2 days after I received the package

by mail apparently produced no results. A part of them were retained in the *infection jar* (quart Mason fruit jar); one-half pint of bugs were collected from the field, 3 days later a foul stench was found to emanate from the jar, and a part of the bugs in it were dead. Only July 3, I took advantage of the cool, damp evening and took a few buckets of cold water and sprinkled the edge of the millet and distributed more infected bugs. On the 6th I found millions of dead bugs. I think the night and sprinkling the millet caused the disease to spread—we have had no rain in this neighborhood since June 17, if I remember correctly. The depredations of chinch bugs are always more serious in dry, hot weather. Have not had my mail since writing you from Humboldt the 5th.

You have conferred a lasting benefit on the farming interests of the United States the value of which can not be estimated in dollars and cents. It was estimated that during one of the visitation years of this insect the damage in the Mississippi Valley amounted to \$10,000,000. I have no doubt that by a proper manipulation of the contagious disease in the hands of intelligent persons it will prove an effective remedy. I think the contagion should be introduced among them early to prevent the migration of the young brood. In my case I received it too late. Early sown millet presents a favorable place to infect the bugs, as they seem to collect in the shade and die. Hoping that when the next legislature meets an appreciating public will suitably reward you for your beneficent discovery,

I am, gratefully, yours,

J. W. G. McCORMICK.

The field experiments were apparently equally successful in the months of July, August, and September.

The following August field report is inserted as a fair sample of the manner in which the farmers themselves regard these experiments:

FLORENCE, KANSAS, November 1, 1890.

Prof. F. H. SNOW:

DEAR SIR: On the 20th of August (I think it was) I wrote to you to send me some infected chinch bugs, and on the 30th of the same month you sent me a small lot of infected bugs (I suppose about thirty in all). I then put with these about twenty times as many healthy ones, and kept them 48 hours, and then deposited them in and through my field. (I have about 55 acres under cultivation.) At the time I wrote for bugs my place was all in corn and a very large crop of chinch bugs. I am safe in saying that there were more bugs on my farm than any two with the same amount of land under cultivation. At the time of sending to you for bugs I told two of my neighbors of my intention, and they laughed at the idea; nevertheless I sent. When I put them in my field it had rained fully a half day, and after noon I commenced to place them about in different places in my field. I noticed no change in the bugs for three days, it being cold; and on the fourth and fifth days the weather was more warm, and it was then that the destruction of the enemy commenced, with great satisfaction to myself and great surprise to my laughing neighbors. One of my neighbors, Mr. George Winchester, said that there ought to be a subscription raised and donated to me. I told him not to me but to you the praise belonged.

I think that it took about 8 days after the five from the time that I placed them in my field before they were all destroyed. The fifth day after I put out the diseased bugs I noticed that a great many bugs were flying away from my place. I can not say if the disease spread in this way or not, or if it spread at all. Three or four persons said that they would come and procure of me some of the dead bugs, but no one came.

This much I can say, with me this experiment has been a complete success. It has done me a great deal of good. I can not give it a money value, but am satisfied that had it not been for the infected bugs obtained of you I would have lost 27 acres of wheat and 8 acres of rye, and when I wrote to you for bugs I then contemplated

putting out considerable wheat; and I was at that time considerably troubled about the bugs in my corn, thinking that if I put out any wheat at all it would be destroyed by bugs; but, thanks to you, my wheat is now safe from bugs, at least those that were on my place before sowing my wheat. I only wish I had written to you sooner than this.

I will send by express one bottle of bugs that I gathered after they commenced to die.

Respectfully,

JOHN F. KNOBLE.

The following report from R. L. Stangaard is inserted as being of a more scientifically circumstantial character than most of the other reports :

FLORENCE, KANSAS, *August 22, 1890.*

Prof. F. H. SNOW.

Lawrence, Kansas:

DEAR SIR: In reply to your favor of July 27, last month, would say that infected bugs were applied after they were kept with live ones about 42 hours. They were applied as follows:

Most of the bugs mixed were dead when taken out of the box. They were applied in seven different hills, being put into every ninth hill. I marked every hill with a number so as to be better able to watch the progress.

Examined after 48 hours application with the following results: No. 1, mostly dead; No. 2, bugs mostly alive, seemingly very restless; No. 3, bugs seem to be sick; No. 4, bugs mostly dead (on hills around the bugs seem restless); No. 5, not examined (on hills around it the bugs seem to be affected, sick). Examination 8 days after application with the following results, to wit: No. 3, bugs seemingly in a dying condition. On the hills around it the bugs seem to be well, with exception of one hill, where they seem to be dying and some dead. No. 4, not a live bug in the hill. No. 5, apparently dying, also dying in the hills around this. No. 6, bugs dying in hill. No. 7, apparently not dying.

On August 16, 12 days after application, I found the bugs to be dying and dead all through the field (12 acres).

On August 20, I again found the bugs to be dying rapidly. A field, being 40 rods distant, had sure marks of bugs in a dying condition. What I mean by bugs being in a dying condition is this: They lay on their backs, almost motionless, and others lay in same position, moving limbs violently.

This remedy was applied on A. G. Rosiere's farm, on Bruno Creek, Marion County, Kansas, being 9 miles east and 3 miles south of Marion.

Thanking you for your favors, I remain, yours, truly,

R. L. STANGAARD.

October 16, many of the bugs were dead; the others apparently lively. The dead bugs were found to contain hyphal bodies similar to those with which they were infected. A live chinch bug from the same jar was crushed and found to contain round hyphal bodies; but these refused to germinate.

November 5, not all of the bugs are yet dead. The few remaining are apparently lively.

The following is a summary of the results of the field experiments in the season of 1890:

Number of boxes of diseased bugs sent out, thirty-eight. Seven of these lots were either not received or received and not used. Reports

were received from twenty-six of the thirty-one remaining cases. Of these twenty-six reports three were unfavorable, nineteen favorable, and four doubtful concerning the success of the experiment. These doubtful cases are not to be looked upon as unfavorable, but more evidence is needed to transfer them to the list of favorable reports. Thus nineteen out of twenty-six reports, or 73 per cent., were decidedly favorable. The experiments will be continued during the season of 1891. In presenting this paper I wish to acknowledge the invaluable aid continually received during the progress of the work from my assistants, Messrs. W. C. Stevens and V. L. Kellogg.

The laboratory experiments have been continued through the season. Of the three diseases identified, that produced by the *Trichoderma* appears to be less fatal than the other two, as is indicated by the following laboratory notes:

September 28, dead chinch bugs, showing no signs of fungus externally, were taken from the infection jars and crushed on a glass slide in distilled water. Oval hyphal bodies of a fungus (*Trichoderma*) were found in considerable number. These were put under a bell jar.

September 29, some of the hyphal bodies had put out slender mycelial growths, others in immense numbers were multiplying by division.

October 1, the hyphal bodies were still multiplying by division. The mycelial growths had become much longer, and in some instances had variously branched.

October 3, a dead chinch bug taken from an infected field was crushed on a glass slide in distilled water. Both round and oval hyphal bodies were found in considerable number. These were put under a bell jar to prevent drying.

October 4, both round and oval hyphal bodies were multiplying by division, and were putting out mycelial growths.

October 5, fresh chinch bugs from an uninfected field were immersed in the liquid containing the above fungi, and were put in a new jar with young corn plants.

To Mr. Riley's question as to which of the three diseases mentioned was most common in destroying the bugs in the field experiments, Mr. Snow said during the dry summer of the present year he thought the bacterial disease did most of the work, but in 1889 he thought the fungous diseases were most destructive.

Mr. Riley thought that the fact that Mr. Snow had been able to carry healthy bugs through the season without infection in the same room with diseased bugs was a rather discouraging one, as it would indicate either that the germs were easily kept from reaching the bugs or that they were not carried long distances. Close proximity to, or actual contact with, diseased individuals, if necessary, would materially lessen the value of their use in the field, while the evidence of farmers' experience in the field needed very careful weighing, because of the possibilities of error.

Mr. Snow said that it had been found by his experiments that the diseases would spread over large fields and destroy nearly all the bugs within 10 or 12 days after the diseased bugs had been introduced, and that the expense was very slight.

Mr. Webster stated that it had been his experience that the spread of the *Entomophthora* was entirely dependent upon proper atmospheric conditions, and that he thought the disease might be continued from year to year by massing the bugs on small patches of some favorite food plant or millet where they are to be infected and destroyed and then growing upon this ground some crop to which the bugs are partial the next year. In this manner the bugs the following year accumulate on the ground where the germs are most abundant and most favorable natural conditions would be offered for starting the disease when proper atmospheric conditions were present. Mr. Webster did not think actual contact necessary for the communication of the fungous diseases, neither did he think that corn fields present favorable situations for the spread of the infection.

Mr. Snow thought none of the germs would live over winter under ordinary outdoor conditions, but only in protected situations, and it was his opinion that such an attempt as Mr. Webster proposed to carry the germs over from one season to another would not succeed. His own experiments had shown that the diseases can be kept alive in the laboratory through the winter and sent out the next season on demand as explained in his paper.

Mr. Cook stated that foul brood was readily carried over winter in a beehive and he thought it not unlikely that the chinch bug diseases might be carried over in the same way. Mr. Fletcher thought that where the disease has been it is liable to appear again when proper conditions are present.

On motion of Mr. F. L. Harvey the committee tendered Mr. Snow a vote of thanks for his interesting and valuable paper.

Mr. Smith moved that the paper and discussions of the committee be sent to *INSECT LIFE* for publication. The motion prevailed.

The committee adjourned.

C. P. GILLETTE, *Secretary*.

FIFTH CONTRIBUTION TO A KNOWLEDGE OF CERTAIN LITTLE-KNOWN APHIDIDÆ.*

By CLARENCE M. WEED.

It is evident that before our knowledge of the Aphides can be said to be in a fairly satisfactory condition we must have descriptions, and

* The first contribution of this series was published in *Psyche*, vol. v, pp. 123-134; the second in *Psyche*, vol. v, pp. 208-210; the third in Bull. Ohio Agricultural Experiment Station, 2d series, vol. i, pp. 148-152; and the fourth in the technical series of the same bulletin, vol. i, pp. 111-120.

so far as possible, illustrations of at least five stages of each species, viz: (1) The egg; (2) the apterous viviparous female; (3) the winged viviparous female; (4) the male; and (5) the oviparous female. Of course, an acquaintance with these forms does not necessarily involve a knowledge of the complete life-history of a given species, especially in those cases where seasonal migrations from one host plant to another occur, but such information will at least furnish a basis for systematic monographic work, and will also prove helpful in tracing the life-cycles.

The studies upon which this series of contributions is based were undertaken especially to learn the autumn and winter history of American Aphididæ. Previous writers have as a rule been content to describe the viviparous forms, and until recently our knowledge of the sexed forms and hibernating stages of nearly all our species was very limited.

The observations upon which the present paper is based were made as a part of the work of the Ohio Agricultural Experiment Station, mostly upon the station farm during the autumn of 1890. The drawings for the illustrations accompanying it were prepared by my assistant, Miss Freda Detmers, from freshly killed specimens, while the descriptions are all drawn up from the living insects.

The Sycamore Lachnus (*Lachnus platanicola* Riley).

This species was described in 1883 by Dr. C. V. Riley in a short note in the *American Naturalist* (vol. 17, pp. 197-198). It is said to have been excessively abundant in 1882 on Sycamore trees over a large part of the United States. The male, oviparous female, and egg are very briefly characterized.

During the present season this insect has been extraordinarily abundant in central Ohio. During the summer and early autumn months nearly every Sycamore tree was thickly infested, and the eggs were deposited on the bark of the twigs and branches in enormous numbers. The sexed forms appeared late in September and throughout October. The deposition of eggs began early in October, continuing for more than a month.

The different stages of the Sycamore Lachnus are shown much magnified at Plate 1. Fig. 1 represents the winged male, Fig. 2, the apterous viviparous female, Fig. 3 the winged viviparous female, and Fig. 4, the eggs. All except the eggs are shown much magnified, the straight line at the right indicating the natural size of each.

Like the other species of the genus these insects have the habit of waving their long hind legs in the air when alarmed.

DESCRIPTION.

APTEROUS VIVIPAROUS FEMALE (Plate 1, Fig. 2, 2a).—Body 6 millimeters long by 3.5 millimeters wide across middle of abdomen; antennæ, 3 millimeters long; posterior legs, 9 millimeters long.

General color light brown, with a glaucous bloom. Antennæ, eyes, most of head, two

triangular spots united basally on middle of pronotum, a large quadrangular spot on middle of mesonotum, one row of small spots on each side of the dorso-meson on the segments posterior to this, another row along each side margin of all the dorsal segments, and a few smaller spots between the middle abdominal terga, together with cornicles, black; coxæ dusky; trochanters and femora, except tips, reddish brown; tips of femora, together with tibiæ and tarsi, black, except that the middle of the tibia is often reddish-brown. Cornicles very short, conical, truncate. Ventral surface dusky, with a glaucous bloom. Rostrum dusky, reaching posterior coxæ. Body, legs, and antennæ furnished with rather long, light-brown hairs. Antennæ roughened; joint III very long, equal to IV plus V, the latter being subequal, though V is slightly longer than IV; VI short, with a well developed thumb, forming VII; V slightly enlarged near tips by a distinct sensorium; and another on VI at the base of the projecting thumb.

WINGED VIVIPAROUS FEMALE. (Plate 1, Fig. 3, 3a).—Body 6 millimeters long, by 3.5 millimeters wide across middle of abdomen; head to tip of folded wings, 10 millimeters; wing expanse, 18 millimeters; antennæ, 3 millimeters; posterior legs, 11 millimeters.

Head and thorax bluish-black with a glaucous bloom; antennæ and cornicles black; dorsum of abdomen whitish, with two rows of black spots on each side of median line, and a transverse series of small, black, indented dots on each segment. Cornicles short, conical, truncate. Ventral surface of abdomen yellowish-brown, with a glaucous bloom. Coxæ concolorous with thorax; trochanters and femora except tips, reddish-brown; tips of femora, together with tibiæ and tarsi, black. Rostrum dusky, reaching posterior coxæ. Body, legs, and antennæ clothed with rather long, light brown hairs. Joints of antennæ of same relative length as in apterous viviparous form. Wings clouded, especially towards base; insertions reddish-brown; veins piceous.

OVIPAROUS FEMALE.—This form does not differ in external appearance from the apterous viviparous female.

WINGED MALE (Plate 1, Fig. 1, 1a).—Body 5 millimeters long, by 2 millimeters wide, across middle of abdomen; head to tip of folded wings, 9 millimeters; wing expanse, 16 millimeters; antennæ, 2.4 millimeters; posterior legs, 8 millimeters.

Head and thorax bluish-black, with a glaucous bloom; antennæ piceous; eyes black. Abdomen small, dorsum whitish, but nearly covered with two rows of large black spots on each side of dorso-meson, and having transverse rows of less distinct indented black dots. Ventral surface of abdomen yellowish-brown, with a glaucous bloom, except posterior extremity, which is black. Coxæ concolorous with thorax; trochanters and femora, except tips, reddish-brown; tips of femora together with tibiæ and tarsi black. Rostrum dusky, reaching slightly behind posterior coxæ. Cornicles black, conical, truncate. Body, legs, and antennæ clothed with rather long, light-brown hairs. Antennæ roughened; joints of same relative length as in apterous viviparous female. Eyes as seen from above subtriangular in form. Wings clouded; insertions light yellowish-brown; veins piceous.

THE EGG (Plate 1, Fig. 4).—Length, 1.8 millimeters; width, 0.5 millimeter. Elongate-ovoid. Orange-brown at first, but changing on exposure to shining black. Covered when first laid with a viscid substance by which it is securely attached to the bark of the twig or limb. Great numbers deposited together.

The Box Elder Chaitophorus (*Chaitophorus negundinis* Thomas).

This species has been abundant the past season on certain trees in this vicinity. After the leaves fall off the insects congregate upon the twigs where the eggs are deposited. The sexed forms appear early in October. The male is apterous, and is represented magnified at *a*, Fig. 23. The oviparous female is shown at *b* of the same figure, while the eggs are represented at *c* and *d*.

DESCRIPTION.

WINGED VIVIPAROUS FEMALE.—Body 2 millimetres long by 1 wide across the abdomen; head to tip of wings, 4.5 millimetres; wing expanse 8 millimetres; antennæ 1.6 millimetres.

Head and thorax dull yellowish-brown; abdomen olive-green; base of antennæ yellowish-brown, remainder piceous; coxæ, trochanters and proximal half of femora yellowish-brown, rest of legs piceous. Wings transparent; veins yellowish-brown; stigma dusky. Body, legs, and antennæ furnished with rather long light-brown hairs.

APTEROUS MALE (Fig. 23, *a*).—Body slender, flattened; dorsal surface tuberculate, each tubercle surmounted by a long, slender, light-brown hair. General color greenish-black, with an indistinct olive-green patch at the base of the cornicles; and in some specimens with the head and prothorax more or less tinged with brown; antennæ piceous, except at base, where they are often greenish; eyes reddish-brown; coxæ, trochanters, and proximal one-third of femora greenish, remainder of legs piceous. Legs hairy. Antennæ hairy; joint III long, equal to IV plus V, these two being subequal, although IV is very slightly the longer; VI short, about one-third as long as the slender VII. Cauda short. Cornicles short. Prothorax with a tubercle on each side, near the posterior border.

OVIPAROUS FEMALE (Fig. 23, *b*).—Body 3 millimetres long by 1.5 wide across middle of abdomen; antennæ 1.4 millimetres long.

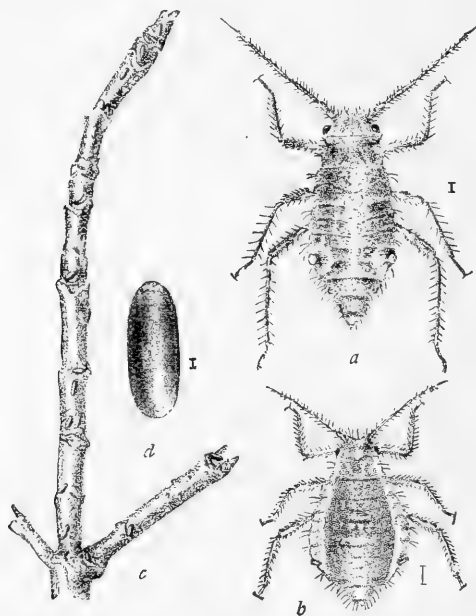


FIG. 23.—*Chaitophorus negundinis*: *a*, apterous male; *b*, oviparous female; *d*, egg; all greatly enlarged; *c*, eggs on twig, natural size (original).

Body somewhat flattened. General color greenish or greenish-brown; head and prothorax brownish; sides of abdomen and cornicles olive-green, with central portion brownish; first two and half of third joints of antennæ light brown, remainder dusky; central portion of entire ventral surface of body, including rostrum, brownish, sides greenish; coxæ, trochanters, and about half of femora yellowish-brown or greenish-brown; rest of femora, together with tibiae and tarsi, piceous. Eyes dusky. Body, legs, and antennæ thickly clothed with long brown hairs. Joint III of antennæ long, not quite equal to IV plus V; IV slightly longer than V, which is longer than VI; VII twice as long as VI. Cornicles short, flanged at tip.

THE EGG (Fig. 23, *c, d*).—Length 0.8 millimetre. Elliptical ovoid, greenish or yellowish-brown when first laid, but gradually changing to a shining black. Deposited on the twigs, preferably about the buds, but often on the bark away from them.

The Cabbage Aphis. (*Aphis brassicæ* L.)

Although this insect has been known both in Europe and America for more than a century, the sexed forms and eggs seem never to have been described. Early in November I found on the Cabbage leaves, in company with colonies of winged and apterous viviparous females, the eggs, oviparous females, winged males, and a form which I conjectured to be the wingless male. The winged males were observed *in copula* with oviparous females a number of times, and the eggs were obtained both on the leaves and from Aphides in confinement.

The winged male is shown at Fig. 24, *a*. It differs from the winged viviparous form principally in the smaller size of its abdomen. The oviparous female is represented at *b* of the same figure. It is easily distinguished from the apterous, viviparous form by its more slender body and tapering abdomen.

DESCRIPTION.

WINGED MALE (Fig. 24, *a*).—Body, 1.2 millimetres long; head to tip of folded wings, 3 millimetres; wing expanse, 5 millimetres; antennæ, 1.6 millimetres.

Body small; head and thorax brown or black; abdomen light greenish-brown, with rows of black spots arranged transversely on dorsum. Legs black, except proximal portions of femora, which are brown. Cornicles dusky, rather short, subcylindrical.

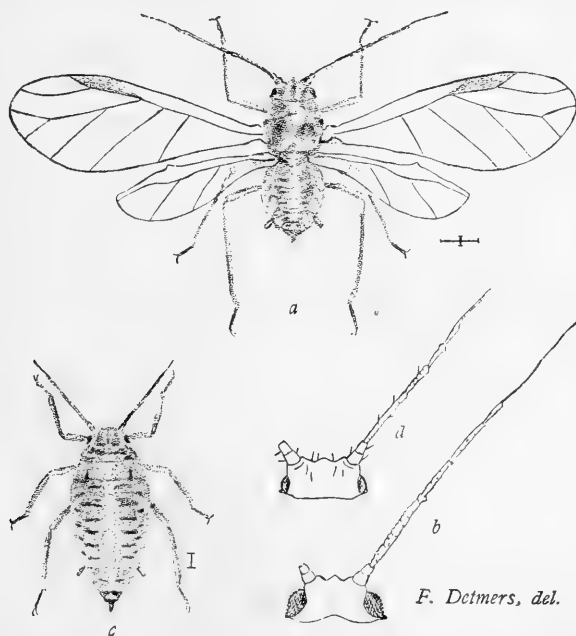


FIG. 24.—*Aphis brassicæ*: *a*, winged male, magnified; *b*, head and antenna of same, more magnified; *c*, viviparous female, magnified; *d*, head and antenna of same, more magnified (original).

drical. Antennæ black; joint III long, as long as IV plus V, which are subequal; VI short, slightly more than half as long V; VII very long, longer than III; all of the joints much roughened. Cauda distinct, dusky. Wings subhyaline, insertions greenish-brown; base of veins and stigma light-brown or greenish-brown; rest of veins dusky. Body more or less covered with a glaucous bloom. Rostrum reaching second coxæ, dusky at tip.

OVIPAROUS FEMALE (Fig. 24, c, d).—One and eight-tenths millimetres long by 1 millimetre wide across middle of abdomen. Antennæ 1.2 millimetres long.

Body elongate oval, tapering both ways from the middle, the abdomen being almost acutely pointed. General color pale-green; head dusky; a row of indistinct dusky spots on dorsum of thorax each side the median line; three longitudinal rows of indistinct small blackish spots on dorsum of abdomen as far back as cornicles; similar spots between cornicles; a transverse dusky patch on last two abdominal segments; cauda dusky. Cornicles short, cylindrical, black. Legs dusky, lighter proximally. Antennæ dusky; joint III longest, equal to IV plus V, which are subequal; VI short; VII rather long, twice as long as VI. All joints roughened.

THE EGG.—Length 0.8 millimetre. Elongate oval. Light-green when first laid, but becoming black on exposure to air. Sometimes more or less covered with a glaucous bloom. Deposited on the cabbage leaves, especially in crevices and depressions.

The Willow Grove *Melanoxanthus*. (*Melanoxanthus salicti* Harr.)

In previous articles of this series I have described the various stages of this insect, and have now to add only one or two recent observations. The occurrence of this species upon Maple and Poplar was mentioned in the last account as probably accidental, but this season's observations show that in some species of Poplar, at least, the insect finds a congenial food plant. Colonies of these lice have repeatedly been observed upon Cottonwood (*Populus monilifera*) at various times during the season, apparently flourishing as well as upon Willow.

To show that the finding of the sexes mating is not always proof that the two forms belong to the same species, mention may be made of an observation during October when a male *M. salicti* was found in copula with an oviparous *Lachnus platanicola*.

The Bicolored *Melanoxanthus*. (*Melanoxanthus bicolor* Oestlund.)

The sexed forms of a *Melanoxanthus* that appear to belong to the species recently described by Professor Oestlund* as *M. bicolor* occurred rather commonly during October and November on the twigs of various willows in company with *M. salicti* Harr. The male is winged, and differs considerably from the male of *M. salicis* or *M. salicti*. The oviparous female represented magnified at Fig. 25, a, is at once distinguished from this form of either of the species named, by its general brown color. Its eggs are laid upon the twigs, generally about the buds, in the same situation as the eggs of *M. salicti*. A couple of them are shown at Fig. 25, c.

* Synopsis Aphididæ of Minnesota, p. 36.

DESCRIPTION.

WINGED MALE.—Body, 2.8 millimetres long; head to tip of folded wings, 5.5 millimetres; wing expanse, 10 millimetres; antennæ, 1.5 millimetres.

Head and thorax blackish or bluish black, with a slight glaucous bloom; dorsum of abdomen yellowish brown, with large blackish quadrangular spots arranged in two longitudinal rows, one on each side the median line; ventral surface of abdomen yellowish brown. Legs piceous, except bases of femora, which are lighter. Cornicles yellowish, rather long for this genus, vasiform. Antennæ piceous, hairy, much roughened; joint III long, but shorter than IV plus V; IV slightly longer than V; VI about one-half as long as V, with the thumbs like VII, very short. Wings subhyaline, with the insertions, veins, and stigma dull yellowish-brown. Cauda and anal plates blackish.

OVIPAROUS FEMALE (Fig. 25, *a, b*).—Body, 4.5 millimetres long by 2.5 wide across middle of abdomen; antennæ, 1.5 millimetres long.

General color, yellowish brown, with the head tawny yellow, and middle of abdominal dorsum almost olive green; a longitudinal row of indented black dots on each side near margins. Body, legs, and antennæ very hairy. Cornicles, yellowish-brown, often slightly dusky at the tip, vasiform. Two front pairs of legs, yellowish-brown, with tips of femora and tibiae, together with tarsi, blackish; third pair, yellowish-brown, with tips of femora and all of tibiae, and tarsi blackish. Antennæ, yellowish-brown proximally, blackish apically; joint III, long; IV and V, subequal; VI, slightly shorter than VII. Rostrum reaching middle coxæ, dusky at tip.

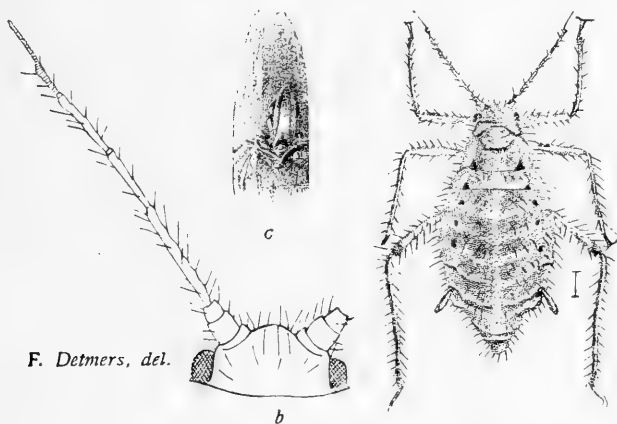


FIG. 25. *Melanoxanthus bicolor*: *a*, oviparous female, enlarged; *b*, head and antennæ of same, more enlarged; *c*, eggs on willow twig, slightly enlarged (original).

THE EGG (Fig. 25 *c*).—Length 1.2 millimetre; oblong oval; yellowish brown at first, but becoming shining black on exposure to air; deposited on the twigs, especially about the buds.

The Flocculent Melanoxanthus. (*Melanoxanthus flocculosus*, n. sp.)

Early in October I saw colonies of a very flocculent plant-louse on Willow bushes in a ravine near Columbus. I recognized it as a *Melanoxanthus*, different from any of the described species, but at the time was unable to make descriptive notes of the viviparous forms then present. The place was not again visited until November 19, when the only

forms present, so far as seen, were the oviparous females and eggs. Wherever colonies had developed upon the stems, there was a whitening of the bark, due to the flocculence of the insects. One or two remains of colonies, with the oviparous females still present in some numbers, were found on the lower portion of certain stems where the flood débris of the creek was piled up for a foot or two. In these places the flocculent matter had developed enormously, so that it looked like a coating of cotton.

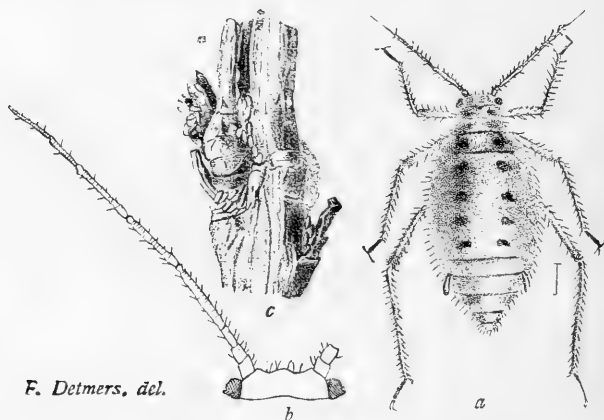
This species appears to be more closely related to *M. salicis* L. than either of the others. Its eggs are covered with a gray coating like those of *M. salicis*, and the cornicles are of the same bright orange-red color.

DESCRIPTION.

OVIPAROUS FEMALE (Fig. 26, *a, b*).—Body 3.5 millimetres long by 2 wide across middle of abdomen; antennæ 2.3 millimetres long.

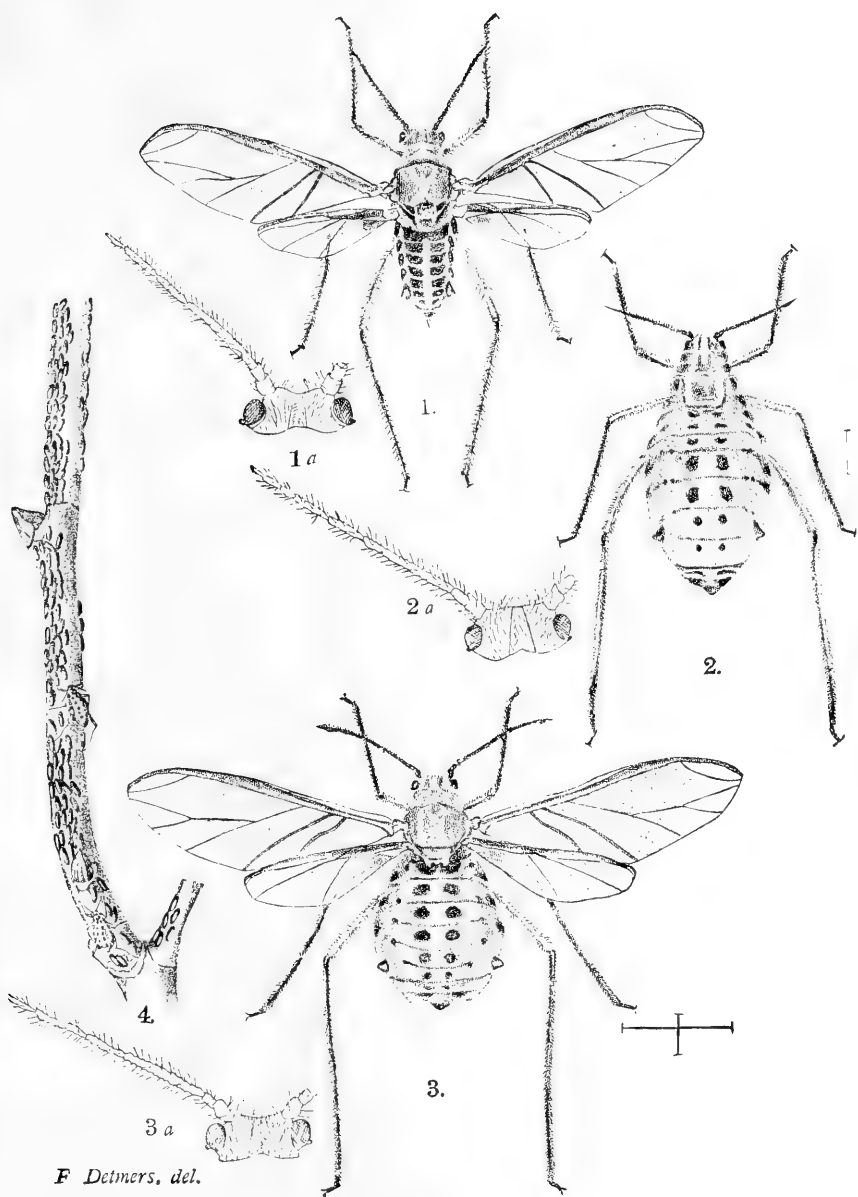
General color dull yellowish-brown, with a longitudinal row of indistinct black spots on each side of dorso-meson; cornicles bright orange red; antennæ dusky, except basal portion of third joint, which is yellowish-brown; legs dusky, with basal portion of femora, and sometimes more or less of tibia, dark yellowish-brown. Body, legs, and antennæ pilose. Joint III of antennæ long, but shorter than IV plus V, which are subequal; VI and VII each rather long, the latter the longer of the two. Cornicles long for this genus; swollen in the middle.

THE EGG (Fig. 26, *c*).—Length, 1.2 millimetres; oblong oval, coated with a thin gray substance like that on the egg of *M. salicis*; deposited on the bark, about the buds and axils, especially where the surface is roughened.



F. Detmers, del.

FIG. 26.—*Melanoxanthus flocculosus*: *a*, oviparous female—enlarged; *b*, head and antennæ of same—greatly enlarged; *c*, eggs on willow bark—one-half larger than natural sizes (original.)



LACHNUS PLATANICOLA Riley

EXPLANATION OF PLATE.

Lachnus platanicola Riley.

Fig 1. Male. Enlarged.

1a. Head and antenna of male. Greatly enlarged.

2. Apterous viviparous female. Enlarged.

2a. Head and antenna of same. Greatly enlarged.

3. Winged viviparous female. Enlarged.

3a. Head and antenna of same. Greatly enlarged.

4. Eggs on Sycamore twig, and oviparous females engaged in oviposition. Natural size.

COLUMBUS, OHIO, November, 1890.

EXTRACTS FROM CORRESPONDENCE.

The Clover-Seed Midge in England, the use of Paris green, and other notes

I think it may be of some interest to you to mention that after 2 years or more of watching I have been able to report your "American Clover-Seed Midge," *Cecidomyia leguminicola* Liatner, as present here detrimentally in clover heads. I have now seen it in its normal larval locality doing plenty of mischief, also at (or rather by) clover roots in the earth in winter, and from this hibernating presence of larva reared the imago myself. I do not like, in a case of such minute identification, to rest solely on my own opinion, so I submitted it to Mr. Meade, who examined it very thoroughly and confirmed my view. I have endeavored to find *trifolii*. As yet, however, although there is another *Cecidomyioides* larva present with that of *leguminicola* at clover roots, I have no evidence of *trifolii* being present. I can not find the leaf galls and I do not know that *trifolii* leave them, but I want very much to make out what the second kind of *Cecidomyioides* larvæ are. They have a somewhat pointed breastbone or anchor process, whereas that of *leguminicola* is bifid.

Amongst new observations of plant attack is serious mischief in one place by infestation of Stem Eelworm (*Tylenchus devastatrix*) in field-bean plants. This was in bean plants after oats, and a sample of the plants sent me (of which the normal height should apparently, from specimen sent, have been 3 to 4 feet) were stunted down to from about 4 to 10 or 12 inches, and many of the pods also greatly stunted and deformed in growth, but not all, and the laden shoots thickly placed together on the central shortened stem had a curious appearance.

Our orchard work with Paris green proved a great success where the directions were properly carried out. Of course we had immense opposition to fight against, but at the Toddington fruit grounds the work resulted in a glorious crop of plums, and in one of the last letters of Captain Corbett (whose decease we all greatly regret) he mentioned that now he thought we could keep the caterpillars in check, and he was truly grateful. Now we are finding the benefit which I hoped for but did not venture to say much on prospectively. We are having reports of a very much lessened amount of presence of wingless moths where treatment was applied. From Toddington, where 3 years ago as many as five hundred moths were caught on one tree trunk by our sticky bands, I have been informed that up to date of observation nine was now the largest number. This satisfactory result is confirmed from elsewhere, as partly, or sometimes, the effect of both banding and Paris green spraying, but sometimes quite demonstrably the effect of the spraying. I hope to give details of this in my next annual report.—[Eleanor A. Ormerod, Torrington House, St. Albans, England, November 24, 1890.]

REPLY.—It is very interesting to know that our Clover-Seed Midge is found with you. I have already had some correspondence with Mr. Inchbald on this subject and have loaned him specimens of our form for comparison. He feels quite sure of the identity of the two, but had not at the time of his last letter reared the adult from the maggots found in England. He has promised to send me specimens of the adult when they appear, but if you already have them and can send me a spare male and female it will enable me to compare with my material at once. From the large series of reared specimens which I have seen I should probably be able to decide the matter.

The other Cecidomyiid larvæ which you found at the roots of clover is not *C. trifolii*, as the larva of the latter has a divided breastbone somewhat like that of *leguminicola*.

I had already learned through the newspapers of your success in having Paris green used in your orchards. I can understand the opposition as we have had to overcome somewhat the same feeling in this country. As you know, however, the arsenical mixtures are now in almost universal use here.—[December 17, 1890.]

The Mantis not poisonous.

A miner friend has just brought me a Mantis. He says it lives on grass in the desert, is eaten by horses and mules, and causes death in 10 hours. The insect is $1\frac{1}{4}$ inches long, with very short wing covers and enormous abdomen, probably filled with eggs. The eyes are chocolate color, prothorax buff, fore legs green, wing covers green, abdomen brownish. The finder is positive of its poisonous qualities. I occasionally see other species of Mantis; have never before heard of their being poisonous, and of course do not believe it.—[W. G. Wright, San Bernardino, California, October 19, 1890.]

REPLY.—You are perfectly right in considering that none of these insects are poisonous. The idea, however, that they cause death to horses and mules when feeding upon grass is not new, and you will find a note upon page 199, Vol. I, INSECT LIFE, under the caption, "A remarkable insect enemy to live stock," where the same statement is published as coming from Texas. If one of these insects was swallowed whole it might for a few moments cause the animal considerable trouble by its struggles, but that it should cause death is, I think, perfectly incredible.—[October 27, 1890.]

A Rose Cecidomyiid.

I send you by this mail a box of buds from the Wootton Rose, afflicted with colonies of a little white grub that destroys whole bunches of these rose buds under glass, so that no bloom is secured after all the pains and expense of a season's work. A person largely engaged in growing cut flowers tells me that for a year past these grubs caused him much loss, and only a few days back was he able to find anything that he could fix as their progenitor, when he discovered the black fly in the bottle. This fellow seems to have a peculiarity that I have not noticed in any insect before, that of rolling up its wings into a little bundle. I am told that in this shape they will go head first into the ground about the plants.—[Benjamin Hammond, Fishkill, New York, October 25, 1890.]

REPLY.—I believe that this little insect is a new enemy to the Rose; at all events I can find no notice of it in the hurried search which I have given. It will be necessary to study its habits pretty carefully before a remedy can be suggested, and I would therefore beg you to send me as much material as possible. The little white maggot is the larva of a two-winged fly of the family *Cecidomyiidae*, to which the Hessian Fly, the Wheat Midge, and a number of other injurious insects belong. The insect in the bottle has nothing whatever to do with the maggot. It is one of the rove-beetles known as *Oxytelus insignitus*, and feeds upon decaying vegetation. The true adult of the maggot is a very delicate fly somewhat resembling a mosquito. Why does not the

gentleman whose roses are troubled with this pest pick off and burn every bud which he finds to be infested? He ought soon to be able to control the insect in this way, or, if he can ascertain the time when the flies are laying their eggs or are issuing from their cocoons, if he will shut his rose house up and puff California Buhach industriously about the place he will certainly kill them all. When the maggots reach full growth they will doubtless crawl out of the buds and drop to the ground and transform to pupæ at or just beneath the surface of the earth, probably in little round delicate cocoons from which the flies will eventually issue.—[October 23, 1890.]

The habits of *Phorodon* in Oregon.

On examining some plum trees yesterday in the vicinity of (what had been) an infested hop field, I found a few specimens of *Phorodon*. From the statement of a Mr. Smeed earlier in the season, who declared positively that they had not touched his Plum trees, I thought it possible that in Oregon they might have chosen a different habitat for autumn, but it now appears that their habits are apparently the same as in the section in which you and your assistants worked. I shall follow the matter up closely, as it is one of considerable financial importance to some of our counties.—[F. L. Washburn, Corvallis, Oregon, October 20, 1890.]

Schizoneura tessellata.

I send inclosed some insects which I believe to be the same as those mentioned in Lintner's Fourth Report, page 179, seventh paragraph. I found them on a branch of Swamp Alder September 12, from the woolly appearance of which I was led to think that the branch was attacked by some species of fungus altogether new to me. Upon breaking off the branch I was surprised to see some of the fungus walk off. The inclosed specimens have shrunk to about one-half of their natural size. Am I correct in supposing them to be *Schizoneura tessellata* Fitch?—[John D. Lyons, Monticello, New York, October 20, 1890.]

REPLY.—The specimens have been examined and you are perfectly right in considering that the species is *Schizoneura tessellata* Fitch.—[October 27, 1890.]

Woodpeckers vs. the Tussock Moth.

In the summer of 1880 the Elms along Euclid avenue, especially in my vicinity, were attacked by the "New Haven Elm-tree Caterpillar." Fearing a repetition of their trouble, numbers of us fought the cocoons in the fall and destroyed thousands, but when winter set in tens of thousands still remained on the outer branches beyond reach. About the first of December a pair of hairy woodpeckers (*Picus villosus*) made their appearance and fed daily off the grubs; in the course of that month and the next over a dozen of the birds were added to the number and by their industry on this particular pest attracted the attention of all who passed. Suffice it to say that when March came not a cocoon was to be seen in those places where the branches were literally white with them before; and more, this is the last we ever saw of the New Haven visitor.—[Dr. E. Sterling, Cleveland, Ohio, October 25, 1890.]

REPLY.—You speak of the insect as the New Haven Elm-tree Caterpillar, but the commonest pests of this tree in New Haven are the larva of the imported Elm-leaf Beetle and the Canker-worm, neither of which spins a cocoon. It is probable that the insect with you was the Tussock Moth caterpillar, since you speak of the branches being "white" with the cocoons.—[October 30, 1890.]

SECOND LETTER.—The caterpillar mentioned in my last was, as you surmised, that of the "Tussock-moth." * * * The Woodpecker, however, did the work for them, as they have never troubled the trees here since, though always a few are to be seen in their season. I have always found the native Woodpecker family the greatest destroyers of insects in every stage of their development, and these birds should be protected by the farmer and orchardist in particular, be it the maligned "sap-sucker"

or the more conspicuous yellow-hammer. A few old ham or beef-bones, with a little meat on them, hung up on the orchard trees in fall and winter time will keep these birds in the neighborhood during the season, if not the year round, and will pay the owner many fold for his trouble. The imported Sparrow will not touch these larvæ, while the Orioles and Jays fatten on them. A pair of pet toads would devour a dozen or more at a sitting that fall to them.

Abnormal Oviposition of the Angular-winged Katydid.

I have the honor to inclose herewith something that may or may not be of interest. I have never seen such things before, and if eggs of any injurious insect, will thank you for information thereabout.—[H. B. Osgood, captain and commissary of subsistence U. S. Army, depot quartermaster, Jefferson Barracks, Missouri, August 18, 1890.

REPLY.—The eggs which, as indicated on the box, you found glued upon your collar when taken from the laundry, are those of the big, angular-winged Katydid (*Microcetrum retinerve*). This is an extraordinary position for these eggs, as they are ordinarily glued to the stems or twigs of different plants. The Katydid is a leaf-feeder through all its stages of existence, but seldom occurs in sufficient numbers to do any appreciable damage.—[August 25, 1890.

Dimorphism in Butterflies and Miscellaneous Notes.

Your note on page 35 of volume III, INSECT LIFE, on Mr. Oberthür's views about dimorphic females of butterflies, is very interesting, and especially so to me, because I have held a similar opinion myself. If you will turn to the *Entomologist*, 1889, p. 5, you will see that my theory on the subject is very similar to that of Mr. Oberthür, so that indeed it can hardly be said that he has suggested a new hypothesis. I do not know whether you intended to imply that he had, but that seems the tendency of the note. However, Mr. Oberthür's opinion on such a matter is certainly more valuable than mine, and I do not wish to seem to undervalue it or to detract from the importance of his observations. Some other naturalists who are very competent disagree with the theory of Mr. Oberthür and myself altogether, but as to who is right only time and observations can prove.

You will remember Mr. Howard's notes on the food of *Carpocapsa pomonella* and the question about Mr. W. West's observations as to its feeding on Walnut. I have asked Mr. West about it, and he assures me that he has bred the true *pomonella* from Walnut. He has also bred it from Chestnut (*Castanea*), as he stated at a meeting of the South London Entomological Society at which I was present. * * *

The *Globe* (published in London) of October 9, 1890, has a long article headed "Disease among Cocoanuts." It states that the Cocoanut plantations in St. Iago de Cuba have been ravaged by a disease which appeared at Matanzas after the cyclone of 1870. It was supposed to be due to a *Uredo*, but Dr. Galves declared that a Coccid was the culprit, and this Coccid he named *Diaspis vandalicus*. Very likely all this is known to you, so I won't enter into details.—[T. D. A. Cockerel, 3 Fairfax Road, Bedford Park, Chiswick, London, West, England, November 1, 1890.

REPLY.—I had overlooked your note in the *Entomologist* for 1889, page 5, but so far as indorsing Mr. Oberthür's theory, the question towards the end of the paragraph has an indication that I do not necessarily believe with him that we shall in all cases find the original form from which the divergent form has in time developed. On the contrary I do not accept it, and such is certainly not to be looked for in the case of our own *Argynnis diana*.

In reference to *Carpocapsa pomonella* on Walnut, I am not inclined to change the opinion arrived at by Mr. Howard, a conclusion which was based on notes which I had made when considering the subject in years gone by, and before changing that opinion I should like very much to have the specimens Mr. West bred submitted to Lord Walsingham or some other good authority, as the chances are they would be found to be *putaminana* Staudinger.—[December 13, 1890.

Kerosene Emulsion against the Sheep Scab.

I have read with great interest Prof. C. P. Gillette's interesting and valuable article reviewed in the last number of *INSECT LIFE* on the application of kerosene emulsion as a sheep-dip. Professor Gillette has most thoroughly treated the subject from an economic standpoint and shown the adaptability of the dip to sheep. Following Mr. Joseph Harris, I suggested in "Animal Parasites of Sheep," its use as a dip against sheep ticks and lice but not against the scab insects. I think that Professor Gillette goes too far in advising its use at present against "other parasitic insects that annoy" the sheep, for until its use is thoroughly demonstrated in the scab diseases by some one with means enough to try the experiment, whether it succeeds or not, its utility as a scab-dip is uncertain, as scab yields only to the most thorough treatment. He who tries the kerosene dip should appreciate that he is making an experiment the success of which is doubtful. Should the application of this dip in the scab diseases be successful we will have a remedy at once comparatively harmless, sufficient, and cheap. Professor Gillette is to be congratulated for the success of his experiment.—[Cooper Curtice, Department of Agriculture, Washington, December 10, 1899.]

On *Nola sexmaculata* and the Japanese Gipsy-moth.

In *INSECT LIFE*, Vol. III, No. 2, p. 61, I note the name *Nola sexmaculata* Grote as still in use. If not generally known in America, it may interest Lepidopterists to learn that the species is identical with Walker's *Lebena trinotata*; strictly speaking it is not a typical *Nola*, the costa of the primaries being relatively longer, and the outer margin consequently more oblique; probably there are better characters for separating it from *Nola*, but just at present I am in the thick of the most difficult genera of *Noctuidæ* and have no time to look for them. I wonder which of the Japanese gipsy moths is the species intended by M. Loomis. *Porthetria dispar* is represented in Japan by at least four species, none of which correspond exactly with the European insect; *P. japonica* Motsch. is considerably larger, more uniformly colored and with fewer markings: *P. umbrosa* Butl. is decidedly smaller and differs in the same way; it may be a natural form of *P. japonica*. *P. hadina*, and *eurydice* Btl. are described from males only and are almost black, without dark border to secondaries; the former larger than males of *P. dispar*, the latter much smaller and very different in pattern of primaries. Allied species, all smaller and referred to a distinct genus, *Enome*, by Walker and others, occur in India; in one or two of these the females appear to be practically apterous, the wings being aborted as in *Orgyia*; but *Porthetria* (*Enome*) *obfuscata* has a winged female differing in coloration, as in *P. dispar*. We hatched eggs of the latter sent from India and reared a number of males on Hawthorn one spring, and as this food did not belong (I believe) to the same natural order as the plant on which it feeds in India, all the specimens were small.—[A. G. Butler, British Museum, London, England, November 21, 1890.]

GENERAL NOTES.

A FIG LEAF BEETLE IN AUSTRALIA.

We notice from an unlabelled newspaper clipping sent us by our esteemed correspondent, Mr. C. O. Montrose, of Shepparton, New South Wales, that Mr. W. W. Froggatt has recently worked up a Leaf-beetle which is doing serious damage to the fig trees in the gardens of Sydney, New South Wales. It is a Chrysomelid closely allied to our common imported Elm Leaf-beetle which it closely resembles in its method of

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work. It is *Galeruca semipullata* Clark. The eggs are pale, cylindrical in shape and are placed in little patches on the underside of the leaves. The larvæ when first hatched are pale and cylindrical and cluster close together when feeding, covering themselves with fine particles of dust from the leaves. They become full grown in 14 days and then descend to the surface of the ground to transform to pupæ under leaves and rubbish.

A GRAPE VINE PEST.

A cosmopolitan leaf-beetle known as *Adoxus vitis* has recently been found by Mr. J. R. Dobbins to be doing considerable damage to a vineyard near Healdsburg, California. The insect was determined by Mr. L. E. Ricksecker, and we have also received specimens. This insect customarily feeds upon the vine as its name indicates, but this is the first case that has come to our notice of its attracting particular attention.

TIN CANS VS. CRICKETS.

In Florida, where crickets often seriously damage choice plants just set out, the plan has been adopted of cutting off the top and bottom of 3 pound fruit cans and placing the resulting cylinder over the very small rose bushes, cuttings and other small choice plants liable to attack.

NOTES ON FRUIT-TREE INSECTS.

Sannina exitiosa.—So far as known to me, the larva of this species has not before been recorded as attacking the cherry. From the trunk of a cherry tree growing in the yard of Mr. T. W. Nolte, at Mount Vernon, Indiana, I took four chrysalids, the adults emerging from these August 10 to 15. These chrysalids were found August 7, and besides cherry there were both peach and plum trees growing in the same yard.

Oberea bimaculata.—Beetles belonging to this species were sent to me by Mr. E. S. Hallett, of New Providence, Indiana, with the statement that they had been given him by a fruit grower, who complained that they were girdling the twigs of his peach and cherry trees. The depredations were committed early in June, and do not appear to have been very serious.

Scolytus rugulosus.—Although this insect has probably been a resident of the State for several years, it was not until the present season brought to my notice. On June 13 the beetles were observed burrowing into the trunks and bases of the larger limbs of peach trees, in the garden of Mr. T. W. Nolte, at Mount Vernon, Indiana, and apparently working serious injury. There were five rows of these trees, and the first tree in the second, third, and fourth rows, had, one after another, dropped their foliage and died. The first tree of the first row, standing in a fence corner, had remained uninjured, although the first of the second row had been the first to sustain attack and die. The

affected tree in the fourth row was not at the time fully dead, but the foliage was turning yellow and falling, while hundreds of beetles were busily at work burrowing into the bark. Others of these rows of trees were also being attacked, but to a much less degree. The three trees most seriously infested were saturated with coal oil and burned as they stood, while those less infested were recommended for treatment with a wash composed of soft soap and carbolic acid.

On July 31 specimens of the beetle and sections of infested apple tree were received from Mr. E. E. Wilkinson, of Princeton, Indiana, with complaints of the ravages of the insects among both apple and pear trees. August 4 and 5 the orchard of Mr. Wilkinson was examined, and a considerable number of trees, both apple and pear, found to be infested by the insect in all of its stages. The orchard comprised 1,000 Ben Davis apple trees set alternately in rows with the same number of Keifer Hybrid pear, the trees having been planted in 1888. The ground had, for the most part, been but recently cleared before the trees were planted, some of it having been cultivated and other portions not. At the time of my visit the land was badly overgrown with weeds and underbrush, and was being pastured with hogs and horses. The owner stated that one tree had been attacked and died in 1888, fifteen or twenty in 1889, and forty or fifty the present year. After considerable time spent in the examination of infested trees, Mr. Wilkinson called my attention to the condition of the roots of infested trees, claiming that the roots of trees attacked in his orchard had been diseased, he was quite sure, prior to their becoming infested by the borers. A further study of his orchard did not prove the correctness of his theory, but did reveal the fact that all trees seriously injured by the insects in question were either diseased at the root, or else had sustained some injury tending to destroy the free circulation of the sap, although the tree itself might appear in a healthy condition.

The orchard of Hon. C. A. Buskirk was next examined. This comprised 500 Keifer Pear trees, 500 Peach trees alternated with 500 Ben Davis Apple trees, and 1,100 miscellaneous Pear trees, all except the last having been purchased of the same dealer, and set out at the same time as Mr. Wilkinson's. The condition of this orchard was entirely different from the one previously examined. Nearly every tree was vigorous and healthy, showing the best of care and attention. The soil above the roots, except where treated with lime and ashes, had been fertilized with stable manure. The land had been thoroughly cultivated, but not cropped between the rows, and no cultivation was given during the latter part of summer. The fatalities from all causes up to date of examination amounted to one Pear and two Peach trees, only the latter having been attacked by *Scolytus*, although the roots of the Pear tree had been attacked by the same fungus to which Mr. Wilkinson attached so much significance. One of the Peach trees had been dug up several weeks before, and from lying out in the hot sun and wind the bark had become thoroughly dead, except that on some of the

larger branches. In this were found great numbers of young larvæ, mostly in burrows in the dead bark, the larvæ being also dead. In the still living bark, on the branches, nearly full-grown living larvæ were found.

The second tree was dug up by Mr. Buskirk and myself, and the roots found to be dead but not covered by the fungus. With the owner, I spent considerable time examining trees in this and other orchards, but found only a single *Scolytus*, which was crawling over the branch of a Peach tree. Returning to the orchard of Mr. Wilkinson with Mr. Buskirk, we spent some hours in a further examination of trees, but in no case found the borers attacking healthy trees, although many of these were having a severe battle for life in their uncongenial environment.

August 7 the trees belonging to Mr. Nolte, at Mount Vernon, were again examined, and no additional attacks observed among the Peach trees. The vigorous growing trees which I saw being attacked in June were as yet uninjured, although the bark on the trunks had been punctured in many places. The female borers had evidently punctured the bark and attempted to burrow beneath it and construct the egg chamber, or cradle, as it is sometimes called, but for some reason gave up in despair. I found them attacking Cherry trees, but the roots were dead, except in case of the one being killed by *Sannina exitiosa*, as detailed at the beginning of this paper. The shoots on very old Apple trees in the process of dying out were also being attacked. No borers could now be found on or about healthy trees of any variety.

In summing up the results of observations on this insect, it would appear (1) that the species attacks only such trees as are already in the process of dying, either from diseased roots or some injury to the trunk, whereby the circulation of the sap is wholly or in part destroyed; (2) the larvæ can not live in wholly dead bark; (3) the adults can not oviposit in a healthy, vigorous tree, but are attracted to trees giving off odors of fermenting or sour sap; (4) they do not appear to be attracted to trees affected by Pear blight; (5) the species is double-brooded, the eggs being deposited in June and August, the insect passing the winter in one or more of its stages in the bark.

Melanoplus differentialis.—Serious depredations to orchards by locusts were reported from several counties in southern Indiana, and I also observed such in Posey and Gibson Counties, the method of attack consisting, aside from the devouring of the leaves, in gnawing of the bark from the smaller branches. This species is the only one which I have been able to detect in connection with the ravages.—F. M. WEBSTER, November 1, 1890.

GALL-PRODUCING HETEROPTERA.

The receipt of a short paper* by our valued correspondent Dr. Fr. Thomas, of Ohrdruf, Germany, reminds us of the fact that although

*Ueber das Heteropteroecidium von *Teucrium capitatum* und anderen Arten (Abhandl.d.bot. Ver d. Prov. Brandenburg, v. 31, pp. 103-107.)

our own fauna is very rich in gall-producing insects—richer, perhaps, than the European fauna—we do not seem to have in North America any gall-producing Heteroptera. In Europe the galls produced by two species of *Lacomotopus* Fieber (family *Tingitidæ*) on the flower buds of *Teucrium chamædrys* were first described by Réaumur in 1738, and since that time these galls have been found on various other species of *Teucrium*. Dr. Thomas gives a full review of the literature on this subject.

THRIPIDÆ INJURIOUS TO CULTIVATED PLANTS.

In the annual report of the Connecticut Agricultural Experiment Station for 1889 (1890), p. 180, are two short preliminary notices, apparently written by Dr. Roland Thaxter, on two injurious species of *Thripidæ*. The "rust" of oats which was much complained of in 1889 throughout Connecticut proved on examination to be caused, in most cases, not by the fungus rusts (*Puccinia coronata* and *P. graminis*) but by a Thrips which is probably identical with Fitch's *Thrips 3-fasciata*, now referred to the genus *Coleothrips*. The so-called "white blast" of market onions, a disease which prevailed to a serious extent in all onion growing districts of the State, is caused by an undescribed species of the genus *Thrips*. In the latter case an application of kerosene emulsion would be a good remedy; for the species injurious to Oats no direct remedy can be suggested.

It is to be hoped that Dr. Thaxter will soon publish in full his observations on this interesting and important subject.

WILL RAMIE SUPPORT THE SILKWORM OF COMMERCE.

A recent number of the *Prairie Farmer* quotes from the *American Druggist* to the effect that a lady of Columbia, South Carolina, reared a brood of young silkworms on Ramie leaves for the reason the worms hatched before the Mulberry or Osage Orange had put forth leaves. The worms fed ravenously and were kept upon this diet until the Osage orange leaves appeared. The worms were then divided equally, one set being fed with Ramie and the other with Osage Orange, with the result that the former produced larger cocoons and a finer quality of silk. We should be glad to receive an authoritative account of such an experiment, as the discovery is a valuable one if true. We have endeavored to secure an authentication, but have not succeeded as yet. In spite of the fact that Ramie is closely related to the Mulberry, botanically speaking, we rather incline to the opinion that the published statement is a canard. The editor of the *American Druggist* writes us that the item must have been published in his advertising pages, and that he can not vouch for the reliability of the statement.

DAMAGE BY THE RED SCALE GROWING LESS.

We have received no announcement of the fact from official or thoroughly reliable sources, but notice in a recent number of the *California Fruit Grower* that the Red Scale is said to be rapidly disappearing in the San Gabriel Valley, and that this is accounted for by the unusual prevalence this season of parasites and predaceous insects.

A SYSTEMATIC WORK ON GALL-MITES.

In the *Botanisches Centralblatt* (vol. 41, Nos. 3-4, 1890, pp. 115-118) Dr. F. Thomas reviews Mr. Alfred Nalepa's recent work entitled "Beiträge zur Systematik der Phytopten."* Although we have not yet seen this work, it is, so far as we are aware, the first attempt at a classification of these mites. Nalepa distinguishes four genera of *Phytoptidæ*, three of which are gall-makers. So far as we can gather from Dr. Thomas's review the work is important from the systematic as well as the biologic standpoint.

MORE FACTS CONCERNING THE KATIPO.

The following statements are taken from an abstract of a paper by Prof. T. W. Kirk, read before the Wellington Field Naturalists' Club December 18, 1889, and from the published discussion:

The author said: We hear a great deal about the Katipo, and yet it is surprising how few persons know one when they see it. Such being the case, he ventured to introduce a specimen or two to the members of the club. He stated that the Katipo was exceedingly common along the seashore of the Wellington district. It may be found in abundance under the stunted bushes that grow between the water's edge and the base of the hills at Lyell Bay; indeed, the specimens exhibited were collected there on the occasion of the club's excursion. There are said to be two distinct varieties, but he thought it had yet to be proved that the differences are not due to age and sex, for he would be able to show that not only do the sexes differ considerably, but also that the Katipo, during the various stages of existence, presents most remarkable variations. Though so plentiful, it is seldom that persons are bitten by the Katipo; and this is the more remarkable when we remember the great numbers of people who throng the seabeach on holidays. The reason: The explanation will probably be found in the fact that this spider is much more active at night than during the day; indeed, the native name is said to mean "night stinger;" and so long as he is not molested, during daylight, he seldom interferes with anyone. The chief food is a species of black beetle, thousands of the wing cases of which may be found under the bushes where Katipos are plentiful. That the bite is very venomous there can be no doubt; and, although the writer was not aware of any European having actually died from the effects of one, there are a number of well authenticated cases in which strong, active persons have been rendered ill for periods varying from a few hours to several months.

The Maoris have a decided dread of the Katipo, and the bite appears to have a much greater effect on a native than on a white man.

The female Katipo is much larger than the male; she is black with a bright orange-red stripe down the middle of the body; sometimes the red is bordered with yellow,

* Published in Sitzber. d. K. Acad. d. Wiss. Wien, 1889, No. 16, p. 162 ff.

in others (generally, I believe, in old specimens) the red widens out in the center, so as to present the appearance of a cross; others have red and white dots at irregular intervals along the margins of the red stripe.

The male has a narrow line of yellow on the back, usually flanked by a similar but less distinct line on each side.

The cocoon exhibited was a fair specimen of that ordinarily produced by the Katipo; it was spun two days after the specimens were captured.

The author had frequently reared young spiders of this species and found that the breeding season appeared to extend from September to March. The young usually escape from the cocoon in about sixty days after the eggs are laid. When first hatched they are white, with dark brown spots on the body; these spots vary in number, but are generally arranged in two distinct lines. As the animals grow, the body assumes a yellowish color, and the red stripe appears on the back, but not so well defined as in the adult specimen.

During the whole of the time from the day the eggs are laid to the appearance of the young brood, the female keeps near the cocoon, and, although she kills any insects that come within reach, seldom eats any of them; but, following a practice common amongst some groups of spiders, she generally devours her husband. The author supposed that was her way of preventing marriage being a failure.

Sir James Hector remarked that he had kept Katipos alive for a long time; cocoons were spun and young brought out, but as soon as they appeared the female ate most of them, so that it was evident her cannibalistic practices were not confined to eating her husband. The poison of the Katipo had some very peculiar properties which had not yet been fully investigated. The spider was common in the northern part of the colony, and had been heard of as far south as Foveaux Strait. He had heard of a person who was bitten being paralyzed for six weeks afterwards. It seemed that a general constitutional change was produced by the bite, not merely a local inflammation, and the numbed feeling extends all over the body for even months. The Tarantula produced intoxication by its bite, quite a different effect from the Katipo sting. He urged members to pursue a systematic course of investigation in regard to the nature of the poison, and the way in which it acted, but to be very careful not to operate on human subjects.

We may also state that in a recent conversation, Mr. Henry Edwards, who has spent many years in Australia, and has just returned from a year's sojourn there, declared that he had no doubt of the poisonous nature of the Katipo, of which he has had personal evidence.

POPULAR NAMES OF INSECTS.

We should be glad to learn from our correspondents in different parts of the country concerning the popular names in vogue in their respective localities for the following insects, each of which seems to have a multiplicity of local designations: The Praying or Carolina Mantis (*Stagmomantis carolina*), the Wheel Bug (*Prionidus cristatus*), the Hellgrammite Fly (*Corydalis cornutus*), the Walking-stick (*Diapheromera femorata*), and any of the Dragon Flies.

OBITUARY.

It is with great regret that we learn of the recent death of our correspondent, Mr. E. T. Atkinson, accountant-general of Bengal, and president of the board of trustees of the Indian museum, who died at Calcutta on September 15, after a short illness from Bright's disease.

We have frequently had occasion in these pages to refer to the entomological work which Mr. Atkinson has been doing in India and most of our readers are familiar with his name and reputation. The following notice from the December number of the *Entomologist's Monthly Magazine* succinctly represents our own sentiment.

Mr. Atkinson was born at Tipperary on September 6, 1840, and passed into the Indian civil service in 1862. He held many important official appointments in India, amongst others that, for a time, of financial secretary to the Indian Government. Between 1874 and 1879 he published a gazetteer of the northwestern provinces of India, and was also the author of works on Indian law and kindred subjects. As an entomologist he published two series of papers on Indian *Rhynchota* from 1885 to 1890, in the *Journal of the Asiatic Society of Bengal*, and a series of catalogues of the insects of the Oriental region. One of his latest works was a bulky catalogue of the *Capsidæ* of the world. Furthermore, he started the "Indian Museum Notes," dealing largely with Indian economic entomology, which he was doing his best to reduce to something like order by collecting information from native and other sources, naturally often very crude, but of the greatest use for future working out. It is most unfortunate for this latter department in particular, and for Indian entomology in general, that he has been cut off just as he had accumulated the knowledge of what was required, and had commenced to place that knowledge to public advantage, and with remarkable energy. This energy of character asserted itself in all his official duties, and his private virtues endeared him to all with whom he came in contact.



SPECIAL NOTES.

Some new Insecticides.*—Mr. G. C. Davis, who has been acting as special agent of the Arkansas Experiment Station during the absence, through illness, of the entomologist, Mr. C. W. Woodworth, reports upon the action of some new insecticides on the Cotton Worm in Bulletin No. 15 of that station. The substances experimented with were: Petroleum sludge, a kerosene extract of pyrethrum, Santonin, oxalic acid, benzoic acid, mercuric chloride, tartar emetic, salicylic acid, cinchonin, bi-chromate of potash, hellebore, lead acetate, and veratrin. All of these substances except the first two were applied in powder in the proportion of from one-fourth ounce to 8 ounces of the insecticide to 1 pound of flour, and none of them proved satisfactory except the veratrin which acts both externally and internally and which, although used in the proportion of one-fourth pound to 1 pound of flour, proved nearly if not entirely equal to Paris Green, costing about the same.

The most important conclusion of the bulletin is, however, the efficacy of the kerosene extract of pyrethrum, which the author states "from present indications seems to be one of the most efficacious and at the same time inexpensive and harmless remedies that we have." The proportions were $2\frac{1}{2}$ pounds of pyrethrum to $1\frac{1}{2}$ gallons of kerosene, which is then emulsified with soap and water. One part of the resultant emulsion to 450 or 500 parts of water is said to be effectual. At a strength of from 500 to 900 parts of water to one of the emulsion, the half grown and smaller worms "seldom escape death." The application of 1 part to 500 of water causes the worms to die in from 12 hours to 2 days according to size. This mixture will kill pupæ when any opening in the loose cocoon allows them to become wet. It is an extremely cheap mixture, and according to the formula given by Mr. Davis, cotton fields can be sprayed at an expense of 5 cents per acre for material.

* Some new insecticides and their effect on cotton worms. Agricultural Experiment Station, Fayetteville, Ark. Bulletin No. 15, December, 1890.

In a prefatory note to the bulletin Mr. Albert E. Menke, the director of the station, states that the substances experimented with were suggested by himself, the kerosene extract of pyrethrum having been obtained by him in the course of experiments to determine the active principle of pyrethrum. In a letter to us, dated October 28, Mr. Menke announces the discovery of this extract as also the use of veratrin as an insecticide and claims priority for both. Regarding the combination of kerosene and pyrethrum, however, we may call attention to the fact that while it is a matter which we have long had in mind and have suggested to some of our agents, Prof. C. P. Gillette was the first to give it public mention (p. 184, Bulletin No. 5, Iowa Experiment Station, May, 1889), though his method of preparing it may differ in detail from that of Mr. Menke. Prof. Jerome McNeill, one of our temporary agents, writes us that the idea of using the combination of these two substances was given to Dr. Menke by him, in conversation soon after the latter's appointment as an agent of this Division, as one of the substances which he intended to experiment with upon Boll Worms.

A few interesting notes concerning the natural enemies of the Cotton Worm are published on pages 9 and 10 of the Bulletin. From these it appears that Mr. Davis has noticed a species of *Panorpa* preying upon the worm, that *Trichogramma pretiosa* Riley probably destroyed nearly one-fourth of the eggs after the latter part of September, while fully one-fourth of the worms subsequent to the second brood were attacked by *Euplectruscom stockii* Howard.

The Hessian Fly attacking Grasses in California.—According to Lindemann the Hessian Fly has been found upon *Phleum pratense* and *Agropyrum repens* in Russia, but up to the present year it had not been recorded as occurring in this country upon any wild grasses.

We are in position now, however, to add four grasses to the list of its food plants in the United States. In 1887 Mr. Koebele sent us from Alameda, California, specimens of *Elymus americanus* and of a species of *Agrostis* which bore puparia supposed to be those of this insect. The adults were not reared, however, and the question remained unsettled. On page 71 of the current volume we published, under the head of "California Notes," a letter from Mr. Koebele in which he mentioned finding Hessian Fly puparia in a grass in the Santa Cruz Mountains. This fact was called in question by Mr. James Fletcher and we wrote Mr. Koebele for specimens and received from him *Bromus ciliatus* and a species of *Agropyrum* both carrying puparia. These were very much like the normal puparia of the Hessian Fly, but were smoother and more plump, showing little trace of the longitudinal ridges. Flies were obtained from these and others also obtained from the grasses were sent on by Mr. Koebele, and after comparing these very carefully with specimens from wheat from different parts of the country we find that

they are not to be separated, although from the specimens first received a variation in the number of the antennal joints raised some doubt. We find, however, after the examination of nearly one hundred specimens of individuals reared from wheat from various sections that the joints of the antennæ in the male range from 16 to 20 and in the female from 16 to 19.

Introduction of *Icerya* into Honolulu and its Extermination through the *Vedalia*.—We call attention to some interesting facts in the Extracts from Correspondence, showing the introduction, doubtless from California, into Honolulu, of the *Icerya*, and the effective manner in which the *Vedalia*, also purposely introduced to destroy it, succeeded in its mission, as it did in California. This second illustration of the effective work in this particular direction done by the *Vedalia* lends great probability to the similar extermination of *Iceryas* in Egypt and in the West Indies by the introduction of the *Vedalia*, which we are now attempting to bring about.

The Plum Gouger and the *Cuculio*.—We have hitherto made no mention of the results of Prof. C. P. Gillette's experiments as detailed in Bulletin No. 9 of the Iowa Agricultural Experiment Station. Yet so far as they relate to the Plum Gouger they are novel and well worth record in these columns. The author has adopted the excellent plan of bringing together his conclusions at the end of his paper and these are in such shape that we quote them :

1. The gouger appears upon the trees much earlier in the spring than does the curculio.
2. The gouger is much more injurious than the curculio to native plums on the grounds of the Iowa Agricultural College.
3. The gouger very much prefers the native to the domestic variety.
4. The examination of over 24,000 native plums, from not less than eighteen different trees of many varieties, showed a little over 27 per cent. of their fruit to be injured by the gouger.
5. The gougers take no food in the fall after emerging from the plums.
6. The gouger has at least one parasite that preys upon it while in the pupa state. The parasite is *Sigalphus canadensis*.
7. The season's experiments indicate that London purple, as recommended for the destruction of the curculio, is of little value for the destruction of the gouger.
8. The gouger is not able to come to maturity in fruit that falls from the trees before the middle of July.
9. Fruit infested by the gouger does not ripen or fall prematurely.
10. About 26 per cent. of the punctures of the gouger result in the production of a beetle.
11. Jarring the trees and collecting the beetles and gathering stung fruit from the trees before the 1st of August are the best remedies at present known for the gouger.
12. The curculio prefers the domesticated to the native varieties of plums.
13. When eggs are deposited in native plums, the curculio develops as well in them as in the domestic varieties.

14. Native varieties are not a protection to domestic varieties. The fact that two Yellow Mira Belle trees growing in the immediate vicinity of many natives had 65 per cent. of their plums destroyed by the curculio, while the natives had less than 10 per cent. of their fruit punctured, is sufficient proof of this.

15. That succulent, quick-growing plums are not less attacked than slow-growing varieties.

16. The curculio develops readily in the Duchess apple.

17. The curculio is not double brooded in Iowa, but the eggs deposited late in July and August are from belated females.

18. The two applications of London purple in water, although not made at the time best suited to destroy the curculio, apparently gave a protection of 44 per cent. against the ravages of this insect.

19. London purple in water in proportion of 1 pound to 120 gallons is much too strong a mixture for plum trees. One-half this strength is as strong a mixture as should be used.

Bulletin XXIII of the Cornell Station.*—Prof. J. H. Comstock and his assistant, Mr. M. V. Slingerland, publish this bulletin as joint authors and devote it to the consideration of certain insects injuring the Pear, Apple, Cherry, Current, Blackberry, and Raspberry. The insects treated are the Pear-Leaf Blister Mite (*Phytoptus pyri*), the Stag Beetle Borer on Pear (*Dorcus parallelus*), the Apple Bucculatrix, (*Bucculatrix pomifoliella*), the Cherry-tree Tortrix (*Cacæcia cerasivorana*), the Cherry-tree Scallop Shell Moth (*Hydria undulata*), a Leaf-roller on Currant (*Cacæcia rosaceana*), and a Blackberry Cane-borer (*Oberea bimaculata*).

The bulletin is illustrated by sixteen figures, all but one of which are new. The opening article is perhaps the most important contribution. The authors show that the mites live within the galls until the drying of the leaves in the autumn, when they migrate to the leaf buds at the ends of the twigs, where, after working their way beneath the leaf scales, they remain through the winter. The remedy proposed is to carefully prune and burn the young wood. This pruning should be supplemented by carefully burning the fallen leaves and rubbish in the orchard. The second article records the feeding of *Dorcus parallelus* upon the tap root of a pear tree. The article upon the Apple Bucculatrix reprints the life-history traced by Mr. Brunn in 1881, and recommends the spraying of kerosene upon the cocoons in winter and of Paris green during June for the larvæ. Under the head of the Blackberry Cane-borer the fact is recorded that, after a careful pruning of infested canes as soon as they had begun to droop, the insect was so completely exterminated as to afford a perfect exemption for two years.

* Cornell University, College of Agriculture. Bulletin of the Agricultural Experiment Station. Entomological Division. XXIII. December, 1890. Insects injurious to fruits.

Evolution of Bristles, Spines, and Tubercles with caterpillars.*—Papers of this character always interest the working entomologist. Dr. Packard, from his broad knowledge of forms, is well qualified to generalize, as he has done in this instance. His paper is confessedly suggested by the "epoch-making work of Weissman" and by the more recent papers of Meldola and Poulton. His thesis is announced in the full title given in our foot-note, and he brings a vast number of observations to bear in its support. He discusses not only the bristles, spines, and tubercles, but also the colorational markings, and incidentally introduces more or less complete descriptions of eighteen Notodontid larvæ, and adds a grouping of these larvæ according to their affinities and also according to their adaptation to arboreal life. The subject is largely speculative, and we give Dr. Packard's conclusions in brief.

1. The more prominent tubercles, and spines or bristles arising from them, are hypertrophied piliferous warts, the warts with the seta or hair which they bear being common to all caterpillars.

2. The hypertrophy or enlargement was probably primarily due to a change of station from herbs to trees, involving better air, a more equable temperature, perhaps a different and better food.

3. The enlarged and specialized tubercles develop more rapidly on certain segments than others, especially the more prominent segments, because the nutritive fluids would tend to more freely supply parts most exposed to external stimuli.

4. The stimuli were in great part due to the visits of insects and birds, resulting in a mimicry of the spines and projections on the trees; the colors (lines and spots) were due to light or shade, with the general result of protective mimicry or adaptation to tree life.

5. As the result of some unknown factor some of the nypodermic cells at the base of the spines became in certain forms specialized so as to secrete a poisonous fluid.

6. After such primitive forms, members of different families, had become established on trees, a process of arboreal segregation or isolation would set in, and intercrossing with low feeders would cease.

7. Heredity, or the unknown factors of which heredity is the result, would go on uninterruptedly; the result being a succession of generations perfectly adapted to arboreal life.

8. Finally the conservative agency of natural selection would operate, constantly tending towards the preservation of the new varieties, species, and genera, and would not cease to act, in a given direction, so long as the environment remained the same.

9. Thus in order to account for the origin of a species, genus, family, order, or even a class, the first steps causing the origination of variations were in the beginning due to the primary (direct and indirect) factors of evolution (Neolamarckism), and the final stages were due to the secondary factors, segregation and natural selection (Darwinism).

*Notes on the evolution of bristles, spines, and tubercles of certain caterpillars, apparently resulting from a change from low feeding to arboreal habits; illustrated by the life-histories of certain notodontians. By Alpheus S. Packard. Extracted from the Proceedings of the Boston Society of Natural History, Vol. XXIV, 1890, pp. 493-560. Plates III and IV.

A study in Insect Embryology.*—Mr. Wheeler has in this paper given us a most interesting review of a very interesting subject. It is a résumé of facts and theories up to the close of 1889 and gives, moreover, an account of his own investigations of the embryonic appendages of the first abdominal segment in *Phyllodromia germanica*, *Periplaneta orientalis*, *Mantis carolina*, *Xiphidium ensiferum*, *Cicada septendecim*, *Zaitha fluminea*, and *Sialis infumata*. Upon the question as to the original functions of these pleuropodia, Mr. Wheeler summarizes the views of investigators who have held that they may have been respiratory organs, sense organs, or glands, and gives in full his reasons for maintaining his previous conclusion, following Patten, that they originally possessed a glandular function. He follows then with a consideration of the odoriferous glands in insects and inclines to the supposition that with primitive forms the pleuropodia were functional as odoriferous organs.

The relationship of Arthropods.†—In a recent paper with this title Dr. H. T. Fernald has given us careful studies of the anatomy of *Anurida maritima*, a degenerate Collembolan, and *Lepisma saccharina* of the Cinura, together with a careful review of the existing views as to the relationship of Arthropods and an ancestral tree embodying his conclusions.

The study of the anatomy of the two forms mentioned is made on account of its bearing upon the theory of Brauer and Lubbock that insects are derived from a Campodea-like ancestor.

Changes in the Force of the Division of Entomology.—One of our assistants, Mr. C. H. Tyler Townsend, has resigned his position to accept the post of Entomologist of the State Experiment Station of New Mexico. The insect fauna in this region is very interesting, and Mr. Townsend will have an admirable opportunity for work in a comparatively new field.

Prof. A. J. Cook, of Lansing, and Mr. J. H. Larrabee, of Vermont, have been appointed special agents of the Division, with special reference to experiments in bee-culture.

Some odd Lepidoptera.—We have recently received several interesting Lepidopterological contributions from our esteemed friend, Mr. W. J.

*On the appendages of the first abdominal segment of embryo insects. By William M. Wheeler. Extracted from the Transactions of the Wisconsin Academy of Sciences, Arts and Letters. Vol. VIII, September 20, 1890.

†The Relationship of Arthropods, by H. T. Fernald, M. S. A thesis for the degree of Doctor of Philosophy at the Johns Hopkins University. Reprinted from *Studies from the Biological Laboratory*, Johns Hopkins University, Vol. IV, No. 7, Baltimore, Md. 1890.

Elwes, of Preston House, Cirencester, England. One of these is a brochure on a very anomalous and interesting group of moths having peculiarly elongated and narrowed hind wings, the title being "On some Moths allied to *Himantopterus*." There has been great difficulty in placing these moths in the proper systematic position, but from Mr. Elwes' paper there can be little doubt that they are closely allied to the *Procridae*, having many characteristics in common with our American species of *Procris*. No less than two subfamilies and five genera have been proposed for this group consisting of nine supposed species, "of which," as Mr. Elwes says, "one or two may not be distinct, and only three are known from sufficiently good specimens of both sexes to enable them to be fully described." We commend the following expression to Lepidopterists, because it fully comports with our own feeling:

It seems to me that descriptions of new species which are to be certainly identified by future workers must be accompanied either by a correct illustration or by such a comparison with their allies as may enable their distinctive characters to be appreciated. I have found that the difficulty of acquiring a correct knowledge of Lepidoptera is greatly increased by the non-comparative descriptions which are often given, so that it is not surprising that few workers have studied exotic moths, or that still fewer of those who have studied them have done so in a thorough and careful way.

On the Lists of Coleoptera published by the Geological Survey of Canada, 1842-'88.—Under this title Mr. W. H. Harrington has brought together in accessible form a somewhat revised compilation of these hitherto almost inaccessible lists, which, although short, derive value from the fact that the specimens were collected in many instances in remote districts and before the influx of settlers, and from the further fact that all but three short recent lists were furnished by Dr. Le Conte. The paper is published in the *Canadian Entomologist*, Vol. XXII, 1890, p. 135, and the author has sent out specially bound extras.

A new Wheat Fly.*—Mr. H. Garman, in Bulletin No. 30 of the Kentucky Station, describes the different stages of *Oscinis variabilis* (?) Loew., which he finds quite abundant in Kentucky, feeding, in the larval state, on young wheat. In the fall it especially infests wheat growing upon spots where the shocks had stood during the summer, and the author has also found the adult in the spring in wheat and grasses, and later in the latter alone. He dwells on the importance of the destruction of volunteer wheat and oats in the fall and winter, on account of the great number of grain insects which they harbor.

* Kentucky Agricultural Experimental Station, Bulletin No. 30, Lexington, August, 1890.

THE XANTHIUM TRYPETA.

(Trypeta æqualis Lw.)

By C. L. MARLATT.

The species of *Xanthium* are such pestiferous weeds and are so widespread in the United States that a knowledge of any insect enemy of importance becomes interesting. The plants of this genus are rank, strong growers, and possess a pungent odor which seems to protect them in a measure from insect attack, as but few insects are known to feed on them as compared with other similarly widely distributed and abundant plants.

But two insects, I believe, have been hitherto recorded to feed upon the *Xanthium*. These are *Rhodobæus tredecimpunctatus* Ill. (*-Sphenophorus pulchellus* Schoen.), an account of which, with figures, is given in Riley's Third Report on the Insects of Missouri, p. 60, and *Syphocoryne xanthi* Cest., an aphid which occurs on the leaves, and which was described by Cestlund in the Fourteenth Report of the Geological Survey of Minnesota, p. 36. In addition to these, Professor Riley has reared *Gortyna nitela* Guen. from the stems, and has, from Mr. Webster, Cecidomyiid larvæ from the roots. Mr. Schwarz informs me that he has reared an undescribed Curculionid (*Baris* sp.) from the roots, and I have taken a very handsome Cerambycid (*Dectes spinosus* Say) on the plant in Kansas under circumstances which leave no doubt but that the *Xanthium* is

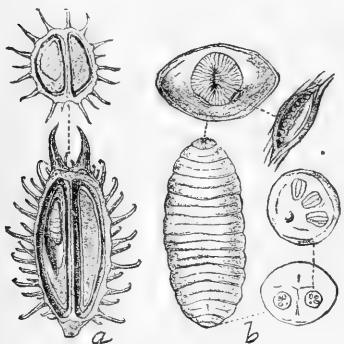


FIG. 27.—*Trypeta æqualis*: *a*, sectional view of the *Xanthium* bar, showing larva in position; *b*, larva enlarged with oral and anal plates still more enlarged with details of the anal and anterior stigmata (original).

its normal food plant. I have also found infesting the seed-pods of this plant a microlepidopterous larva, which I have been unable to rear.

Of greater promise of economic importance, perhaps, than any of these is the *Trypeta* named above, the larvæ of which I have known for a number of years to infest the *Xanthium* seeds, but which, until the last summer, I have not succeeded in rearing to the adult stage. A full account of this insect is given in No. 1, Vol. II, of the Proceedings of the Entomological Society of Washington (pp. 40-44).

It seems to be as widely distributed as its food-plant, as I have found the larvæ both at Manhattan, Kans., and in the District of Columbia, and the adult is recorded from Illinois, Ohio, and Maryland, and specimens slightly differing but probably of the same species have been taken in Colorado. A single female was also recently sent to Professor Riley, for determination, by Professor Gillette, of Iowa.

The accompanying illustrations will give a good idea of the habit and appearance of the larva. (Fig. 27*b*)

When full grown the larva is about 5 millimetres long by 2 millimetres wide, is considerably flattened, and is light yellowish or resinous in color. All of the many specimens examined, some of which were apparently immature, had the appearance given in the illustration, which, however, seems to approach the contracted condition of the puparium. The larva has never been found to occur in more than one of the two seeds normally contained in the *Xanthium* bur.

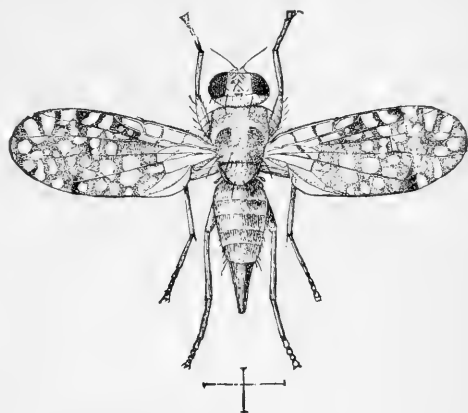


FIG. 28.—*Trypeta æqualis*. Female fly, enlarged (original).

It reaches full growth in September or October, and passes the winter in the bur unchanged, as represented at Fig. 27a. In July the transformation to puparium and adult takes place, the latter emerging late in July or early in August, and doubtless effects its escape from the tough pod by the opening of the latter incident to the germination of the uninjured seed. The new burs are at this season green and succulent, and can readily be pierced by the female in oviposition.

The adult insect, the female of which is shown at Fig. 28, is uniformly yellowish in color, and has the characteristic brownish maculation of the wings indicated in the illustration.

VARIATIONS IN THE BRACONID GENUS LYSIPHLEBUS.

BY D. W. COQUILLET.

In the proceedings of the U. S. National Museum, 1888, pages 664 to 669, Mr. W. H. Ashmead has published descriptions of twelve supposed new species of *Lysiphlebus*, and makes mention of three other species, all of which are included in a synoptical table of the North American species. The types of four of these supposed new species were furnished by myself, and before submitting them to Professor Riley I carefully examined them, and reached the conclusion that they all belonged to one and the same species. I was therefore not a little surprised to learn that Mr. Ashmead had made *four* distinct species out of them. After perusing the above paper, for a copy of which I am indebted to its energetic author, I determined to investigate the subject still further; accordingly, on the 14th of December, 1889, I collected a colony of parasitized aphids from a single bush of *Baccharis viminalis* and confined them in one of my breeding cages. Between December 18 and January 4 121 specimens of *Lysiphlebus* had issued; of which number 57 were

males and 64 females. Separating these according to the number of antennal joints (a character upon which Mr. Ashmead lays great stress) gave the following results:

Males:

- 14 antennal joints, 18 specimens.
- 15 antennal joints, 37 specimens.
- 16 antennal joints, 1 specimen.
- 15 joints in one antenna and 16 in the other, 1 specimen.

Females:

- 12 antennal joints, 7 specimens.
- 13 antennal joints, 54 specimens.
- 14 antennal joints, 1 specimen.
- 12 joints in one antenna and 13 in the other, 2 specimens.

From this it will be seen that the normal number of antennal joints in these specimens is fifteen for the male and thirteen for the female, in each sex the number varying by one joint more or one less than the usual number, the tendency being in the direction of a less number of joints. In those having an unequal number of joints in the antennæ of the same individual this is evidently the result of a consolidation of the last two joints in one of the antennæ, since the last joint in the antenna containing the fewest joints is always longer than the last joint in the opposite antenna. This process, however, will not account for the varying number of antennal joints in the different individuals of the same sex; thus, in the male with sixteen antennal joints the last joint is comparatively as long as it is in the males with only fourteen antennal joints. As a rule, the specimens with the fewest antennal joints are smaller than the others, and this is also the case with the specimens examined by Mr. Ashmead.

Taking the 37 males with 15-jointed antennæ above referred to, I am unable to discover any character or characters by which they can be separated into distinct species, or even into varieties. The last antennal joint varies all the way from slightly shorter to one-half longer than the preceding joint; petiole of abdomen usually yellowish, sometimes with a dusky spot above posteriorly, this spot becoming larger in different specimens until the entire upper side of the petiole is blackish, and this color is rarely still further extended until the entire petiole, except a small spot on either side, is blackish; middle coxæ usually blackish, except the apex, but this color varies in extent in the different individuals until only the extreme base of the coxæ is black; hind tarsi vary all the way from as long as to much longer than their tibiæ; the second section of the radius varies from one-half as long to nearly as long as the first section; the transverse cubital nervure is sometimes hyaline in the middle or is wholly hyaline, and in one specimen it is entirely wanting in one wing, while in the opposite wing only a fragment of it remains, but in another specimen it is entirely absent in each wing.

The 54 females with 13-jointed antennæ above referred to vary to the

same extent as do the above males; the last antennal joint varies all the way from once and a half to twice as long as the preceding joint.

Besides the above, I also bred 58 specimens of *Lysiphlebus* from a single colony of aphids found on a tame rose bush. Separating these as the preceding, gives the following results:

Males:

14 antennal joints, 10 specimens.

15 antennal joints, 19 specimens.

14 joints in one antenna and 15 in the other, 2 specimens.

Females:

12 antennal joints, 2 specimens.

13 antennal joints, 25 specimens.

These specimens varied in the same manner and nearly to the same extent as did those bred from the aphids on *Baccharis*, and I am unable to separate them specifically from the latter.

In my collection are 5 specimens from the same lot of *Lysiphlebus* as Mr. Ashmead described his *L. abutilaphidis* from; one of the males and one of the females have the antennæ as in the described specimens, but in another male the antennæ are 15-jointed, while in two of the females they are only 12-jointed.

From the above it seems very evident that the number of joints in the antennæ varies in the different specimens belonging to the same species of *Lysiphlebus*. If a form with a given number of antennal joints would only confine its attacks to a single species of aphid there might then be some room for believing that this form represented a species distinct from those having a greater or less number of antennal joints; but when the same form is bred from different kinds of aphids, and the different forms are bred from the same colony of aphids, not in a single instance, but in nearly every instance, there is very little room to doubt that the number of antennal joints varies in the different individuals belonging to the same species of *Lysiphlebus*.

From a careful study of a large series of specimens of *Lysiphlebus* from this locality I am firmly convinced that the forms described by Mr. Ashmead under the name of *Lysiphlebus piciventris*, *L. eragrostaphidis*, *L. coquilletti*, *L. abutilaphidis*, and *L. baccharaphidis*, all refer to one and the same species. To this category also belongs the *Aphidaria basilaris* of Provancher, specimens from the same lot as Mr. Ashmead described his *L. eragrostaphidis* having been referred to the above species by L'Abbé Provancher himself. In the paper above referred to Mr. Ashmead considers *A. basilaris* as being identical with his own previously described *Aphidius citraphis*, so that the name and synonymy of this species, so far as at present determined, will stand about as follows:

Lysiphlebus citraphis (Ashm.).

Aphidius citraphis Ashm.
Aphidaria basilaris Prov.
Lysiphlebus piciventris Ashm.
L. eragrostaphidis Ashm.

L. coquilletti Ashm.
L. abutilaphidis Ashm.
L. baccharaphidis Ashm.

BIRTH OF A BEAUTIFUL EXOTIC LEPIDOPTEROUS INSECT IN NEW YORK.

By HENRY EDWARDS, *New York City.*

Some years since Mr. William Grey, of Albany, called my attention to a most beautiful *Castnia* of which he had raised both ♂ and ♀ from the roots of an orchid in the hot-house of Erastus Corning, esq., of Albany, and was so good as to furnish me with an excellent drawing of the ♂ insect, as well as to allow me a sight of the specimens, from which I made at the time a full description, intended for publication in "Papilio." By some means, however, my notes were mislaid, and have only now been recovered. I hasten, therefore, to place on record the facts with reference to the species, and if these lines should reach the growers of orchids or lilaceous plants, to beg them to look carefully in their plant-houses for any such strange visitors as the present.

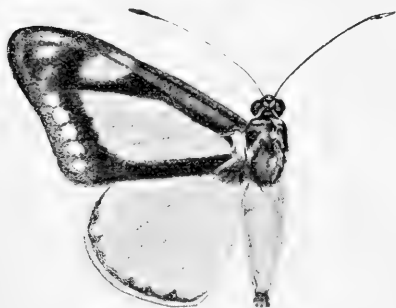


FIG. 29. — *Castnia cronis*, var. *corningii*, male (original).

The larvæ of the *Castnias* and those of the allied genus *Synemon* are internal feeders, and are found in the stems or roots of plants belonging to the natural orders *Bromeliaceæ*, *Iridaceæ*, *Lilaceæ*, *Amaryllidaceæ*, and *Orchidaceæ*. The pupa, like that of *Cossus*, and *Hepialus*, is furnished with a series of small hooked spines on the segments of the abdomen, and when ready to undergo its change to the imago state works itself by aid of these spines close to the entrance of its burrow, the pupa being protruded beyond it on the emergence of the insect. In the excellent, but too brief, monograph of the group by Prof. J. O. Westwood are given excellent figures of the transformations of a Chilean species, *C. eudesmis* Gray, which will give a clear idea of the structure of the early stages. The species in question differs considerably from the type to which it must be referred, and I propose, therefore, to distinguish it by a varietal name, viz :

CASTNIA CRONIS Cram., var. **CORNINGII**.—Ground color of the wing, velvety black. Disk with a clear white mark, running parallel with internal margin, and reaching nearly to the base, whence it is separated by a narrow black line from another white triangular spot which touches the thorax, at the extreme base of the wing. On the upper edge this mark runs obliquely but almost parallel with costa, to about the center of the wing; there it is cut off straight along the corner of the median vein. The space thus inclosed covers about one-third of the whole wing. On the costa is a large ovate spot, and along the margin, only near the internal angle, are 5 sub-triangular spots, and 2 oblong spots at the apex, all clear white. The costa is reddish at the base. Secondaries yellow-white, with rather narrow black margin slightly dentate on the inner edge. Beneath, the markings are repeated, but the ovate mark on costa of primaries, is here triangular, and there is a second triangular mark nearer

the apex. Head black, with 2 white spots at the base of the antennæ, and 1 in front. Thorax also black, with red line at the sides, and 4 transverse white dashes. The red line at base of costa is also carried on to the thorax. Abdomen cream white, with the tip orange. Beneath, the abdomen and thorax are clear white, the coxæ and tibiæ black. Exp. wings, 62 millimetres. Length of body, 28 milometres. 1 ♂, 1 ♀. Raised from roots of *Lælia majalis* in the hot-house of Erastus Corning, esq., Albany, N. Y., by Mr. W. Grey.

Habitat, Oaxaca, Mexico.

In Cramer, in which *C. cronis* is figured, the locality is given as Surinam, and in Herrich-Schäffer, Samml.-ausser. Schm., Fig. 142, *C. cronida*, which is believed by Westwood to be but a form of *cronis*, the country is quoted as "Guyane française." It is, therefore, probable that our species is a strongly marked local form of the same insect. The figure of Cramer, Vol. I, Pl. 60, Fig. C, differs from the Albany specimens in having the large subtriangular discal mark smaller, and by the presence of a broad white basal dash above this mark, *i. e.*, between it and the costa. The submarginal spots are also much larger and more sharply defined than in *corningii*, those in the apex of the latter being lost in the brown cloud of the ground color. The secondaries, too, in Cramer's figure, are wholly without the marginal black band, and are represented as pure white. In H.-Schäffer's figure of *C. cronida*, another system of marking prevails on the secondaries. The marginal band is very broad, occupying one-third of the wing, is waved inwardly about the middle, and incloses a series of six small white spots, mostly ovate in shape. The primaries bear a greater resemblance to *Corningii* than they do to *cronis* Cramer.

THE STRAWBERRY-LEAF FLEA BEETLE (*Haltica ignita*) IN INDIANA.

By F. M. WEBSTER.

As a pest of the strawberry field this insect has this year, in Indiana at least, proven itself to be of no small importance. The first report of its depredations came from Mr. J. Beard, of New Albany, in extreme southern Indiana, who wrote early in September that the insect had been very destructive, beginning its work soon after the mulch was burned (probably as early at least as July), and was exceedingly abundant, often as many as twenty or more beetles being found on a single plant, nearly all of the old plants being destroyed. Mr. Beard was of the opinion that they were nothing new, only a little more numerous than usual. Similar reports of injury to the strawberry came later from various localities and extending as far north as Indianapolis. In all cases reported the method of attack appeared to agree almost exactly with that described as occurring at Orlando, Florida. (See INSECT LIFE, vol. II, p. 369.)

I have not been able to secure information in regard to the occurrence of these beetles early in the season, and they seemed to disappear from the fields about the 1st of September. At any rate, so far as reported, July and August are the months during which they are the most destructive. The burning over of the strawberry fields after the crop of fruit has been removed, has become very popular among strawberry growers, and it is upon the young plants or foliage which appear after this that the beetle is most destructive. However, even where no burning has been done, portions of fields have been attacked and the plants destroyed. From what is now known, it would seem that arsenical poisons might be used to destroy the beetles after the fruit has been removed, but whether this will prove an efficient preventive or not yet remains to be learned. One thing is certain, the insect is too important to ignore, and the sooner we can learn its life history, and what remedies to apply, the better it will be for the strawberry grower.

DECEMBER 8, 1890.

ANOTHER PARASITIC ROVE BEETLE.

By D. W. COQUILLET, *Los Angeles, Cal.*

Up to the present time but very little has been published concerning the early stages of the *Staphylinidæ*, a family of beetles commonly known by the name of "rove beetles." Until quite recently they were generally supposed to feed upon decayed vegetable and animal substances, or upon excrementitious matter, but recent investigations prove that at least a few of the species are predaceous, attacking small, soft-bodied Dipterous larvæ.

On one occasion I saw a Staphylinid larva feeding upon a Dipterous larva in a decayed apple: and I find by referring to my note book that on the 19th of February, 1889, I saw three beetles belonging to the genus *Homalota*, and each of them had a Dipterous larva in its jaws.

Some kinds of rove beetles while in the larva state burrow into the puparia of certain species of Diptera, and feed upon the internal parts. The only other insects known to have a similar habit belong to the orders Hymenoptera and Diptera. Among the literature at my command I find only two instances recorded where rove beetles have been bred from Dipterous puparia: *Aleochara nitida* Grav., bred by Mr. P. S. Sprague from a puparium of *Anthomyia brassicæ* Bouché. (American Entomologist, II, 370.); and an undetermined species of *Aleochara* bred from a puparium of *Anthomyia ceparum* Meigen, presumably by Mr. James Fletcher (Sixteenth Annual Rept. Ent. Soc. of Ontario, p. 11). So far as I am aware these two are the only published instances of beetles of any kind having lived in the larva state within the bodies of other insects.

On the 2d of December, 1888, I found a small Coleopterous larva that was at that moment busily engaged in gnawing its way into a puparium of a Syrphid fly (*Copestylum marginatum* Say), which, in the larva state, lives in the semiliquid substance in the interior of decayed cactus leaves (*Opuntia engelmanni* Salm.). The larva was only 2.5 millimeters long, and worked very actively, appearing to stand on its head and waving its abdomen about in its efforts to penetrate the skin of the puparium. At the expiration of 24 hours it had completely buried itself in the interior of the puparium, and I saw nothing more of it for a whole month, when it issued through an irregular hole in the upper side of the puparium and soon afterwards spun an irregular, thin, tough, white cocoon in the bottom of the breeding cage. The beetle issued about 11 weeks later.

After the discovery of this larva and its curious habits I collected quite a number of the puparia of this fly and succeeded in obtaining from them over two dozen larvæ similar to the one referred to above; all of these in due time spun their cocoons, entered the pupa state, and were finally changed to beetles. Some of these were submitted to Professor Riley who identified them as belonging to *Maseochara valida* Leconte; and they agree very well with specimens of this species named for me a few years ago by Dr. Horn. This species is quite common around Los Angeles in early spring, but I can not find any mention of it in the various published lists of Coleoptera occurring east of the Rocky Mountains.

The full-grown larva, after issuing from the puparium in which it has lived, very closely resembles Figure 393, page 447, of Packard's well-known "Guide to the Study of Insects." In his figures of Staphylinid larvæ (*i.e.*, Figures 386, 387, and 388), and also in Schaupp's figure of the larva of *Staphylinus vulpinus* (Bulletin Brooklyn Ent. Soc., vol. III, Plate 10, Fig. F), the head is larger in proportion to the body, the latter is more slender and elongated, and the structure of the last abdominal segment is altogether different from that of the *Maseochara* larva above referred to. None of these species, however, belong to the same tribe as the latter.

It is interesting to note that all of the rove beetles referred to above as being predaceous or parasitic belong to only three very closely related genera, and that all of the insects preyed upon by them belong to the Diptera, and that, too, to the group which pupate within the hardened skins of the larvæ.

PHOSPHORESCENT MYRIOPODS.

By LAWRENCE BRUNER.

The note on "Phosphorescent Centipedes" in the November number of INSECT LIFE (Vol. III, No. 4, p. 173) calls to mind a very interesting experience which the writer had with these light-emitting myriopods

during the summer of 1877. At the time in question he was living on a farm about 3 miles west of the city of Omaha, Nebraska, and devoting some time to collecting insects. One night, a damp one and rather cool, during the month of June, or possibly later in the summer, as he was walking through a pasture that had not been burnt over for a number of years, something that looked like a double series of small beads of fire was observed crawling about among the dead grass. This was certainly something new and needed investigation. An investigation was accordingly made and resulted in the taking of three or four moderately large myriopods which were producing the light. These were carried to the house, and next day transferred to an ordinary tin cigar box where they were placed between layers of fresh green moss, and put away in a shady nook behind the house. In this locality they were kept alive for a week or more, and examined carefully day after day.

That these were not the larvæ of some Elaterid, but true Myriopods there can be no doubt. They were a many-jointed affair, with two pairs of legs to each joint. Then, too, they laid a dozen or more eggs while confined in the cigar box between the layers of moss. These eggs were globular, of a semitransparent whitish color; and were, as nearly as remembered now, about 1.75 to 2 millimetres in diameter. The full-grown myriopods were very similar in their general appearance to our common prairie "many-leg" that often occurs by the millions and is then known as the "army worm." The luminous species now under consideration is, however, a trifle the larger form. As nearly as memory serves, they must have been fully $1\frac{1}{2}$ to $1\frac{3}{4}$ inches in length and one-fourth inch in width. In color they were yellowish brown, and had the edges of each segment margined with a narrow yellow line above. There were also two small round yellow marks upon each segment dorsally, one near each lateral edge. These latter were about 1 millimetre in diameter, and were the source of the phosphorescence when the animal was placed in the dark. The light that was emitted was whitish and, if it is remembered correctly, more marked or intense at one time than another.

Just what has become of these few specimens of luminous myriopods is not known; but it is the writer's impression that they were put in alcohol with a lot of other things and put away for "keeps," since all efforts to discover them since have proved fruitless. Neither has the old farm been visited since at the right time of the year to secure other specimens.

If it is correctly remembered, the fact of finding these light-producing myriopods was mentioned to Professor Riley, who seemed to doubt the determination, suggesting that they might be the larva of *Melanactes piceus*,* or some other closely related Elaterid or Lampyrid. That they were not these latter it is positively known, from the fact that at

*Now known to be Lampyrid (*Phengodes* and *Zarhipis*).—Eds.

the time a copy of Le Baron's Fourth Illinois Report was referred to and a careful comparison made with the figure of that insect. Then, too, the writer has always (that is from a period as far back in life as he can recollect) known the difference between a "thousand-legged" worm and a "worm."

Everything being favorable the coming summer, it is the present intention to secure specimens of this luminous Nebraska myriopod that will speak for themselves. In the meanwhile let us hear from other American entomologists who may have seen light-producing myriopods in this country.

The animal is, without doubt, exclusively a nocturnal form, since a careful search during daytime failed to reveal any specimens of it.

THE PREPARATORY STAGES OF EUSTROTIA CADUCA.

By D. S. KELLICOTT, *Columbus, Ohio.*

At Rives Junction, Jackson County, Michigan, in July, 1876, I obtained from a larva found eating the fruit of *Nuphar advena*, a species of *Eustrotia* which Mr. Grote described and named in *Canadian Entomologist*, Vol. VIII, p. 207, *Eustrotia caduca*. I have since sought for this larva in many localities without success until July of this year at Corunna, Michigan, where it occurred, not uncommonly, on the yellow pond lily growing in the Shiawassee River. At the time of the first finding I had but recently commenced to observe insects, and very imperfect notes were made; the more favorable opportunity of last month has enabled me to give more exact data concerning its characters and habits.

The eggs.—These are placed on the upper side of floating leaves, in irregular patches of a few in number, and at a little distance from one another. They are hemispherical, 1 millimetre in diameter, and with a waxy hue; the surface is beset with about thirty meridional, nodular ridges.

The young escape by cutting nearly off a round lid which it lifts on a hinge. Soon after escaping the larvæ are 2 millimetres in length with large head and slender body; the skin is green with numerous piliferous spots. The first molt occurred the third day; after this event the length was 7 millimetres; the black spots had disappeared leaving the general color pale green with faint white dorsal and subdorsal lines, head lustrous and immaculate. The subsequent growth was rapid and there was no other notable change until the last molt, so I will only describe before and after this change. Those under observation reached this period July 11. They were then 20 millimetres in length, elongated, tapering slightly from the middle to the extremities; head narrow, smooth, pale luteous with faint brown dots, body naked, pale yellow-

green markings almost obsolete; there are, however, faint dorsal, subdorsal and stigmatal lines; legs and feet concolorous or paler; stigmata elliptical, white with dark rings.

By July 15 maturity was attained; an average larva was then 32 millimetres long, of the same general form, but the coloration was darker and the ornamentation quite decided. In this respect there were two easily distinguished varieties, a darker and a lighter. The subdorsal and stigmatal lines were reënforced by interrupted reddish brown stripes, or in the lighter ones by rows of reddish spots on the posterior edges of the rings in place of the stripes; in the darker ones the dorsal lines often have the spots on either side. Several mature larvæ were seen without a trace of the red marks. The head at this stage was strongly speckled with small brown spots.

The cocoon consists of a delicate gauze of white silk through which the pupa may be seen and to which it is firmly fastened by the cremastral hooklets.

The pupa measures 14 millimetres; the color dark brown and black; there are no distinguishing features. Cocoons upon the leaves.

The imago began to issue after a pupal period of 8 days.

Those found in 1876, as before said, were feeding in the fruit; in the present instance they were invariably found devouring the leaves. In case these are floating, they were found exposed on the upper surface; in other cases they were beneath or concealed in folds. When at rest or when disturbed the head is thrown round—usually to the left—opposite the middle of the body, so that the animal has the form of an inverted J.

It doubtless becomes necessary for larvæ feeding, as this one does, to swim freely. That of *Arzama obliquata*, for instance, swims powerfully by horizontal undulations of its body, while that of *Eustrotia caduca* swims strongly, but by an entirely different motion, *i. e.*, the posterior third of the body is bent downwards, like the tail of a crayfish, then quickly pushed backward, thus kicking the water and driving itself ahead by jerks.

A LIST OF SPHINGIDÆ AND BOMBYCIDÆ TAKEN BY ELECTRIC LAMPS AT POUGHKEEPSIE, N. Y.

BY HARRISON G. DYAR.

The specimens enumerated in the following list were taken from the globes of part of the electric lamps at Poughkeepsie at intervals of about a week during the summer of 1890, from June 14 to August 14, inclusive. In many instances the moths were left in the globes from after one visit to the next, so that the numbers given under the heading of a certain day often include those of the preceding 6 or 7 days. Before June 14 no large number of specimens were caught, and after

August 14 they had almost ceased to come in, partly because of the lateness of the season, but more on account of the cold and rainy weather that followed.

The Sphingidæ were comparatively few in number, being most abundant from July 9 to 17; 21 species were taken in 122 examples. The most abundant species was *Paonias myops*, followed by *P. excæcatus* and *Protoparce celeus*, as may be seen from the list.

The Bombycidæ were much more numerous, 93 species being taken in 7,871 examples. The three species, *Halisidota tessellata*, *Clisiocampa americana*, and *Hyphantria cunea* were most abundant, comprising 82 per cent. of the whole. *H. tessellata* and *C. americana* comprise 65 per cent., while *H. cunea* forms 48 per cent. of the remainder, leaving only 18 per cent. for the other 90 species. It will be seen that the number of specimens captured increases rapidly to a maximum on June 24 and then decreases regularly, with the exception of July 28, when but a small lot were taken. The numbers represent the number of each species that was taken sufficiently well preserved for identification. In a few instances they are followed by an interrogation mark (?) when the identification was at best doubtful.

From a consideration of the figures I think at a fair estimate the electric lights of Poughkeepsie must destroy annually 25,000 Bombycidæ, of which fully 8,000 are *Halisidota tessellata*. I wish to express my thanks to Mr. James H. Van Norstrand, of Poughkeepsie, who has charge of trimming the lamps that I visited, for his kind coöperation in the collection of these moths.

Name of species.	June 14.	June 20.	June 24.	July 2.	July 9.	July 17.	July 28.	August 4.	August 14.	Total.
<i>Sphingidæ.</i>										
<i>Deilephila chamænerii</i> Harr	1	1								2
<i>Deilephila lineata</i> Fabr	1								1	2
<i>Philampelus pandorus</i> Hb.								1	1	2
<i>Philampelus achemon</i> Drur.	1				2			1		4
<i>Ampelophaga choerilus</i> Cr.	1					1				2
<i>Ampelophaga myron</i> Cr.		1	1		1	3	1	1		8
<i>Ampelophaga versicolor</i> H.					1					1
<i>Protoparce celeus</i> Burm.				1	5	2	2	3	1	14
<i>Protoparce carolina</i> Linn.					2					2
<i>Sphinx kalmiæ</i> S. & A.						1		2		3
<i>Sphinx drupiferarum</i> S. & A.				1						1
<i>Sphinx gordius</i> Cram.	1									1
<i>Sphinx chersis</i> Hüb.	1				1	1		1	2	5
<i>Chlenogramma jasminearum</i> Bd.						1				1
<i>Ceratomia amyntor</i> Hb.				1	1		2			4
<i>Ellema harrisii</i> Clem.					1					1
<i>Triptogon modesta</i> Harr.				1	2					3
<i>Smerinthus geminatus</i> Say							1	4	2	7
<i>Paonias excæcatus</i> S. & A.					6	5	1	6	3	21
<i>Paonias myops</i> S. & A.		4	2	5	9	5	1	4	6	36
<i>Paonias astylus</i> Dur.	1					1?				2
Total	6	6	3	8	30	22	8	23	16	122
<i>Bombycidæ.</i>										
<i>Crambidia pallida</i> Pck.						1			5	6
<i>Hypoprepia fucosa</i> Hüb.					9	8	5	6	4	32
<i>Euphanessa mendica</i> Wlk.		1	1	3	3					8

Name of species.	June 14.	June 20.	June 24.	July 2.	July 9.	July 17.	July 28.	August 4.	August 14.	Total.
<i>Bombycidae</i> —Continued.										
<i>Crocota</i> sp*.....				1		2			18	20
<i>Crocota</i> sp*.....				1					1	2
<i>Utetheisa bella</i> Linn.....			1	1	5	6		14	2	29
<i>Aretia virgo</i> Linn.....						1	1	4		6
<i>Aretia nais</i> Dur.....	5	9	3	1				3	14	35
<i>Aretia virguncula</i> Kb.....	4									4
<i>Aretia arge</i> Dur.....							1	2	7	10
<i>Pyrrharcia isabella</i> A. & S.....	8	10	15	6	9	1			34	83
<i>Phragmatobia rubricosa</i> H.....				1	6	10	1	13	14	45
<i>Leucarcia acraea</i> Dur.....	1	10	4	2	2		1	1	26	47
<i>Spilosoma virginica</i> F.....	6	8	4	9	5	5	1	24	60	122
<i>Spilosoma latipennis</i> St.....		1								1
<i>Spilosoma autogenea</i> Streck.....		4		3	1					8
<i>Hyphantria cunea</i> Drur.....	8	167	51	543	140	16	14	180	197	1,306
<i>Euchaetes egle</i> Dur.....		8	1	2	3	3			1	18
<i>Euchaetes collaris</i> Fitch.....	2	4	5	12	3	1		1	5	33
<i>Epantheria scribbonia</i> S.....	1									1
<i>Halisdota tessellata</i> A. & S.....	15	67	65	204	712	865	117	576	55	2,676
<i>Halisdota caryæ</i> Harr.....	11	24	6	4						45
<i>Halisdota maculata</i> H.....		1								1
<i>Orgyia definita</i> Pack.....								2		2
<i>Orgyia leucostigma</i>				5	9	20	4	4		42
<i>Parorgyia clintonii</i> G. & R.....						2		2	2	6
<i>Parorgyia parallela</i> G. & R.....							1			1
<i>Parorgyia cinamomea</i> G. & R.....								1		1
<i>Lagoa crispata</i> Pack.....	2	5	2	4	2					15
<i>Euclea querceti</i> H.-S.....	3	5	7	8	7	7				37
<i>Parasa fraterna</i> Gr.....					1	1				2
<i>Empretia stimulea</i> Cl.....					3	3				6
<i>Limacodes scapha</i> H.....				1	6	2	1	5		15
<i>Limacodes biguttata</i> P.....				1	1					2
<i>Limacodes y-inversa</i> P.....				1	5	2				8
<i>Limacodes fasciola</i> H.-S.....				2	2				1	5
<i>Limacodes flexuosa</i> Gr.....					2	2	1	3		8
<i>Limacodes ctesonia</i> Gr.....				1						1
<i>Sisyrosea inornata</i> G. & R.....				2	1					3
<i>Adoneta spinuloides</i> H.-S.....								1		1
<i>Ichthyura inclusa</i> Hb.....				1						1
<i>Ichthyura albosignea</i> F.....								1		1
<i>Ichthyura vani</i> Fitch.....		1		1					15	16
<i>Apatelodes torrefacta</i> A. & S.....	1	2		1	1					5
<i>Apatelodes angelica</i> Gr.....				1	4	2				7
<i>Datana ministra</i> Dur.....	6	3		2	11	19	3	7		51
<i>Datana drexlii</i> Hy. Edw.....					1?		1?			2
<i>Datana augusti</i> G. & R.....				1						1
<i>Datana major</i> G. & R.....					1?			1?		2
<i>Datana integerrima</i> G. & R.....	1	1	1	1	5	7		1		12
<i>Datana palmii</i> Beut.....					2					7
<i>Datana perspicua</i> G. & R.....					22	27	2	9	5	65
<i>Nadata gibbosa</i> A. & S.....	1	1			1	2				5
<i>Notodonta stragula</i> Gr.....								1	1	2
<i>Lophodonta ferruginea</i> P.....					1					1
<i>Lophodonta georgica</i> H.-S.....			1							1
<i>Pheosia rimosa</i> Pack.....								1	2	3
<i>Nerice bidentata</i> Wlk.....								5	3	8
<i>Edema albifrons</i> A. & S.....	3	7	2	10	2	3		2		29
<i>Seiromonta bilineata</i> Pck.....	3	2	2	6	4	1		3	5	26
<i>Cedeniasia concinna</i> A. & S.....		1						2		3
<i>Edemasia eximia</i> Gr.....					1					1
<i>Dasylophia anguina</i> A. & S.....					1					1
<i>Schizura ipomea</i> Dbd.....				1					1	2
<i>Schizura unicornis</i> A. & S.....						1			6	7
<i>Schizura leptinoides</i> Gr.....		1	1			2				4
<i>Ianassa liquicolor</i> Wlk.....	2			1		2		5	1	11
<i>Heterocampa obliqua</i> P.....						1		2		3
<i>Heterocampa subrotata</i> H.....								2	2	4
<i>Heterocampa elongata</i> G. & R.....		1								1
<i>Heterocampa biundata</i> W.....	2	4		1				1		7
<i>Heterocampa unicolor</i> Pack.....								1	2	3
<i>Heterocampa mantes</i> Dbd.....						1		1		2
<i>Cerura borealis</i> Bd.....							1?			1
<i>Cerura occidentalis</i> Lint.....						1	1	10	3	15
<i>Cerura cinerea</i> Walk.....				1	1	3			1	6
<i>Cerura multiscrypta</i> R.....									1	1
<i>Dryopteris rosea</i> Wlk.....				1						1
<i>Actias luna</i> Linn.....		1		1						2
<i>Telea polyphemus</i> Cr.....	1	1	3	9	13	7	4	14	2	54

* I have not identified the species of *Crocota*. At least two occurred, probably more.

Name of species.	June 14.	June 20.	June 24.	July 2.	July 9.	July 17.	July 28.	August 4.	August 14.	Total.
<i>Bombycidae</i> —Continued.										
<i>Calosamia promethea</i> D					3	1				4
<i>Calosamia angulifera</i> W					1					1
<i>Platysamia cecropia</i> Linn	1	3	4	23	15	3				49
<i>Hyperchiria io</i> Fabr*	12	13	14	20	27	9	9	2		106
<i>Eacles imperialis</i> Dur		2	1	5	16	7	5	4		40
<i>Citheronia regalis</i> Fab.		2	1	1	4	1	1	4		14
<i>Anisota stigma</i> Fab	1			3	3	2				9
<i>Dryocampa rubicunda</i> F.	3			3	8	8	2	2	2	28
<i>Chisiocampa americana</i> H.	15	508	1,382	429	82	3				2,419
<i>Chisiocampa dissidia</i> Hb		1		82	29		1	5		118
<i>Gastropacha americana</i> H				1	1					2
<i>Tolyte laricis</i> Fitch									4	4
<i>Prionoxystus robiniae</i> Peck		1	1	2	2	3			1	10
Total	118	881	1,578	1,424	1,193	1,074	178	917	503	7,871

* Male and female specimens occurred in this species in the following proportion, which is typical of all. Beginning with about 8 per cent ♀ the proportion increases as the specimens taken are older.

<i>H. io</i> ♂	11	12	12	18	23	8	7	1?		92
<i>H. io</i> ♀	1	1	2	2	4	1	2	1?		14

STEPS TOWARDS A REVISION OF CHAMBERS' INDEX, WITH NOTES AND DESCRIPTIONS OF NEW SPECIES.

By LORD WALSLINGHAM.

[Continued from p. 326 of vol. II.]

LITHOCOLLETIS, Z.

I have lately had the advantage of purchasing the types of North American *Tineidæ* which were used by Professor Frey for the descriptions contained in three papers published in the Stettiner Entomologische Zeitung. They confirm with very few exceptions the conclusions arrived at from independent evidence as to the synonymy of the numerous species lately noticed in "Steps towards a Revision of Chambers' Index." In one or two instances it is necessary to make slight corrections and as these should not be delayed I submit herewith a revised list of the recognized American species of the genus *Lithocolletis* in what appears to be their natural sequence according to their relationship with the European species as arranged in Staudinger and Wocke's Catalogue.

This list embodies the following corrections:

1. *Lithocolletis argentifimbriella*, Clem. (1859).
= *fuscocostella*, Chamb. (1875).
2. *Lithocolletis quercialbella*, Fitch, (1859).
= *longestriata*, F. & B. (1873).
= *quercibella*, Chamb. (1875).
3. *Lithocolletis subaureola*, Frey, (1878).

The type of *longestriata* F. & B. has enabled me to recognize Chambers' description of *quercibella* as more applicable to it than to *subaureola* Frey, with which I had previously placed it. *L. subaureola* Frey must for the present be regarded as a good species, but *longestriata* F. & B. and *quercibella* Chamb. must give way to *quercialbella* Fitch, of which they are synonyms. *L. fuscocostella* Chamb. has already been rightly identified as a synonym of *argentifimbriella* Clem.

L. quercialbella Fitch is distinguished from *argentifimbriella* Clem. by having three instead of four dark margined costal streaks and by the first of these streaks being only slightly oblique and almost exactly opposite to the first dorsal streak, whereas in *argentifimbriella* the second costal is opposite the first dorsal and the first costal is very oblique and decidedly precedes it. In his description Fitch writes "three or four" costal streaks; it is possible that he may have had both species before him, but his further remark that the costal and dorsal streaks radiate from a common center applies with far more correctness to *longestriata* F. & B. than to *argentifimbriella* Clem., in which the oblique first costal streak is very decidedly separate from the others.

***Lithocolletis fragilella* F. & B.**

= *trifasciella* (? Hw.) F. & B.

The single specimen on which Frey and Boll founded their announcement (with a "?") of the occurrence of *trifasciella* Hw. in America is now before me, and although it confirms my opinion that it is distinct from the European form its greater size may possibly separate it from *fragilella* should its life history be worked out, but there is apparently nothing in its markings to distinguish it, and it will be safer to regard it as a form of that species, at least until a series of specimens can be examined.

***Lithocolletis alni*.**

= *alnivorella*, Chamb.

Chambers' description of *Lithocolletis alnivorella* appeared in the Cincinnati Quarterly Journal of Science, vol. II, p. 302, No. 4, which contains the description, is dated October, 1875.

In the Annales de la Société Entomologique de France, Bulletin No. 51, p. 112, issued on the 14th of April, 1875, Ragonot described a new European species as *Lithocolletis alnivorella*.

The name *alnivorella* is consequently preoccupied in this genus and I would suggest that the American species should in future be known as *Lithocolletis alni*.

***Lithocolletis fasciella*.**

= *unifasciella* Chamb.

Lithocolletis unifasciella Chamb. was described in the Cincinnati Quarterly Journal of Science, vol. II, pp. 103-4 (1875). This name is also preoccupied by a European species described by Tengström in 1865. I propose that the American species be known as *Lithocolletis fasciella*.

***Lithocolletis betulivora* sp. n.**

Antennæ, grayish above, white beneath.

Palpi, white.

Head and face, white, crown tufted with reddish-saffron.

Thorax, reddish, saffron.

Fore wings, shining reddish-saffron, no basal streak, a small costal spot at one-fourth the wing length and a small dorsal spot nearer to the base dull white, a slender fascia at the middle of the wing angulated outwardly near the costal margin has one or two black scales on its outer edge; beyond this a small costal streak and an opposite dorsal streak, both dull white, with a few blackish scales on their outer edges. A group of black scales at the apex of the wing is preceded on the costal and dorsal margins by dull white, not sufficiently conspicuous to be called costal and dorsal streaks; cilia grayish, their bases tinged with saffron, a slender blackish line along their middle, passing round the apex.

Hind wings, dark gray; cilia gray.

Abdomen, gray tinged with saffron posteriorly.

Hind legs, whitish, with a very faint indication of darker scaling on the penultimate tarsal joint.

Exp. : al. :—7 millimetres.

Hab.—United States.

Type ♀ *Mus. Wlsm.*

Received from Dr. Riley, bred from birch, 1884. This species can not be confounded with any of the birch-feeding species of Europe, among which *cavella* Z. approaches it more nearly than others.

Lithocolletis grindeliella, sp. n.

Antennæ, dull gray, with slightly paler annulations.

Palpi, grayish.

Head, crown tufted with mixed iron gray and reddish brown scales; face grayish.

Thorax, ferruginous.

Fore wings, pale ferruginous, dusted with iron gray and clouded with blackish scales beyond the middle of the wing to the apex; three whitish costal streaks, very indistinct, at about equal distances apart, the first and second of which are outwardly oblique and are met at a somewhat acute angle on the middle of the wing by two even less distinct dorsal streaks, faintly dark margined externally; the third is a mere spot, opposite which is a small spot at the base of the cilia at the anal angle; immediately preceding the apex is a conspicuous curved white costal spot divided from a smaller and less conspicuous one below it by the cloudy streak of black scales which runs to the apex; cilia with a ferruginous tinge, becoming gray at and within the anal angle, and having a few black scales below the apex.

Hind wings and cilia, grey.

Abdomen, dull grey; anal tuft pale.

Legs, whitish, tarsal joints unspotted, tibiæ barred with gray externally.

Exp. : al. : 8 millimetres.

Hab., Alameda County, California.

Type ♂ *Mus. Wlsm.*

This description taken from a specimen given me by Dr. Riley was bred from *Grindelia robusta* in October. It is nearly allied to *solidaginis* F. & B. but is somewhat more suffused with dark scales along the costal portion of the wing.

Lithocolletis faginella Z.

In my previous paper, while I mentioned this species in the list of larvæ and their food plants [Ins. Life II. p. 120 (1889)] I forgot to record its occurrence in America on the evidence of a specimen in Dr. Riley's collection which can not be separated from the European forms of this species. I have no information as to the exact locality whence it was obtained.

LITHOCOLLETIS.

1. hagenii, F. & B. (1873).
= *necopinusella* Chamb. (1878).
2. fitchella, Clem. (1860).
= § *quercifoliella*, Fitch, (1859), [*Argyromiges*].
= *quercitorum* F. & B. (1873).
3. rileyella, (Chamb. 1875).
= *tenuistrigata*, F. & B. (1876).
4. insignis, Wlsm. (1889).
5. clemensella, Chamb. (1871).
6. lucidicostella, Clem. (1859).
7. argentifimbriella, Clem. (1859).
= *fusocostella*, Chamb. (1875).
8. quercualbella, Fitch, (1859).
= *longestriata*, F. & B. (1873).
= *quercibella*, Chamb. (1875).
= *quercipulchella*, Chamb. (1878), *MS.*
9. subaureola, Frey, (1878).
10. caryalbella, Chamb. (1871).
11. lucetiella, Clem. (1859).
= *œnigmatella* F. & B. (1873).
12. albanotella, Chamb. (1875).
13. alniella (? Z., 1846), F. & B., N. America (1873).
14. ostensackenella, Fitch (1859). [*Argyromiges*.]
= *robiniella*, Fitch (1859). [*Anacamptis*, larva only.]
= *ornatella*, Chamb. (1871). [*Leucanthiza*.]
15. gemmea, F. & B. (1873).
16. robiniella, Clem. (1858).
= *pseudacaciella*, Fitch (1859). [*Argyromiges*.]
17. uhlerella, Fitch (1859). [*Argyromiges*.]
= *amorphœella*, Chamb. (1877).
= *amorphæa*, Frey (1878).
18. morrisella, Fitch (1859). [*Argyromiges*.]
= *robiniella*, Clem. (1859—*partim*).
= *texanella*, Z. (1875).
= *amphicarpæella*, Chamb. (1877).
19. pomifoliella, Z. (1839).
= *cratægella*, Clem. (1859).
= *deceptusella*, Chamb. (1879).
20. faginella, Z. (1846).
21. incarnella, Wlsm. (1889).
22. alnicolella, Wlsm. (1889).
23. alni, Wlsm. (1890).
= § *alnivorella*, Chamb. (1875).
24. ostryæfoliella, Clem. (1859).
= *mirifica*, F. & B. (1873).
25. minutella, Frey (1878).
26. diaphanella, Frey (1878).
27. scudderella, F. & B. (1873).
28. obsoleta, F. & B. (1873).
29. obscuricostella, Clem. (1859).
= *virginiella*, Chamb. (1871).
30. æriferella, Clem. (1859).
31. sexnotella, Chamb. (1880).
32. argentinotella, Clem. (1859).
33. occitanica, F. & B. (1876).
34. amœna, Frey (1878).
35. celtifoliella, Chamb. (1871).
= *nonfasciella*, Chamb. (1871).
= *celtisella*, Chamb. (1871).
= *pusillifoliella* F. & B. (1876).
36. cincinnatiella, Chamb. (1871).
37. caryæfoliella, Clem. (1859).
= *juglandiella*, Clem. (1861), *larva*.
38. macrocarpella, Frey (1878).
39. umbellulariæ, Wlsm. (1889).
40. gaultheriella, Wlsm. (1889).
41. ledella, Wlsm. (1889).
42. nemoris, Wlsm. (1889).
43. ulmella, Chamb. (1871).
= *modesta*, F. & B. (1876).
44. conglomeratella, Z. (1875).
= *bicolorella*, Chamb. (1878).
= *obtusilobæ*, Frey (1878).
45. quercivorella, Chamb. (1879).
46. australisella, Chamb. (1878).
47. solidaginis, F. & B. (1875).
= *solidaginisella*, Chamb. (1880).
48. grindeliella, Wlsm. (1890).
49. chambersella, Wlsm. (1889).
= § *quinquenotella*, Chamb. (1880).
50. basistrigella, Clem. (1859).
= *intermedia*, F. & B. (1873).
51. auronitens, F. & B. (1874).
52. desmodiella, Clem. (1859).
= *gregariella*, Mrt. (1881).
53. toxicodendri, Frey, (1878).
54. aceriella, Clem. (1859).
55. guttiffinitella, Clem. (1859).
var. a. *guttiffinitella*, Clem. + *æscu-*
lella, Chamb. (1871). *Var.*
an. sp.?
56. obstrictella, Clem. (1859).
57. coryliella, Chamb. (1871).
var. a. *coryliella*, Chamb. + *ostry-*
ella, Chamb. (1871).
58. oregonensis, Wlsm. (1889).
59. tiliella, Chamb. (1871).

60. *symphoricarpella*, Chamb.
symphoricarpacea, Chamb. (1875).
= *symphoricarpella*, Frey. (1878).
61. *fragilella*, Frey. (1878).
= *trifasciella* (? Hw.), F. & B.
(1873). ? *Syn. an. sp. nov.*
62. *affinis*, F. & B. (1876).
63. *mariella*, Chamb. (1875).
64. *tritæniella*, Chamb. (1871).
= *consimilella*, F. & B. (1873).
65. *fasciella*, Wlsm. (1890).
= *unifasciella*, Chamb. (1875).
66. *castanella*, Chamb. (1875).
67. *bostonica*, F. & B. (1873).
68. *ignota*, F. & B. (1873).
= *helianthisella*, Chamb. (1874).
= *helianthivorella*, Chamb. (1875).
69. *ambrosiella*, Chamb. (1871).
= *nobilissima*, Frey (1878). MS.
70. *elephantopodella*, Frey (1878).
71. *actinomeridis*, Frey (1878).
72. *eppelsheimii*, Frey (1878).
73. *bethuniella*, Chamb. (1871).
74. *lebertella*, Frey (1878).
75. *betulivora*, Wlsm. (1890).
76. *bifasciella*, Chamb. (1878).
77. *tubiferella*, Clem. (1860).
78. *populiella*, Chamb. (1878).
79. *atomariella*, Z. (1875).
80. *salicifoliella*, Chamb., (1871).
[?=*salicifoliella*, Clem. (1861) *larva.*]
81. *hamadryadella*, Clem. (1859).
= *alternatella*, Z. (1875).

EXTRACTS FROM CORRESPONDENCE.

The *Icerya* in Honolulu.

Yours of the 18th instant in regard to the *Icerya* at Honolulu is received. Something over 3 years ago I sent a letter of inquiry and inclosed specimens of the *Icerya* and Red Scale to Mr. Irwin, of Honolulu, but heard nothing from it until the past summer, when I received a letter from Mr. A. Jaeger, to whom my letter of inquiry had been shown. Among other things Mr. Jaeger writes me under date of May 17, 1890, as follows:

* * * "The rest of them (scales) have made their appearance, one after the other, and last but not least, the cottony scale, about 9 months or perhaps a year ago. When in September last my attention was first called to this new insect I had no idea of its destructiveness. As a matter of fact we have this curse on fifty or more premises (gardens) in the neighborhood of Honolulu, and if we do not make great efforts to destroy the same our gardens and perhaps the whole country may be ruined." Before writing to me Mr. Jaeger had sent specimens of the pest to Dr. H. W. Harkness, the President of the California Academy of Sciences, and Dr. Harkness pronounced it the genuine *Icerya purchasi*, and advised Mr. Jaeger to write to me for some of the Vedalias. President Kercheval, of our county board of horticulture, and Inspector Weis, of this city, collected a colony of the Vedalias and I put them up for shipment to Honolulu, where they arrived in good condition and were colonized upon the *Icerya* infested trees and plants.

This is all the information that I possess upon this subject, but will make further inquiries, and apprise you of the result.—[D. W. Coquillett, Los Angeles, Cal., Nov. 24. 1890.

MR. JAEGER'S ANSWER TO INQUIRIES JUST MENTIONED.—Your letter of November 25, has duly come to hand, and I am glad to be able to answer your questions.

1. *Locality where the Icerya was found.*—Seaboard of Honolulu, including Waiki and Kalihi, distance about 7 miles, the whole stretch being say from 2 to 4 miles in width. No reports have been received from other districts or from any of the other Islands.

2. *First introduction.*—Spring or summer of 1889; first specimens seen by myself and others in September; looked upon them as curiosities. In April, 1890, however, awoke to a sense of danger. At a meeting held during the month a gentleman asserted that he had not planted a new tree or shrub on his premises for years, and still they were

infested worse with *Icerya* than any of his neighbors, and attributed it to the bringing home of boxes of California fruit at the arrival of every steamer.

This gave me a clew as to how the *Icerya* might have come here. I found that all the trees (principally samang) on the leeward side of the California Fruit Store (so-called) were very badly infested with this scale, whilst within a quarter of a mile distant none could be found, and even trees of the same kind (samang) about 60 feet to windward I found perfectly clean; the same results with other fruit stores, only there were not so many trees near by. This was in May. I have no doubt that we are indebted to our California friends for this pest, but as they have been otherwise kind to us we readily forgive.

3. *Damage*.—None to speak of; a few of course; have cut down some good trees, although they were advised not to.

4. *Plants attacked*.—All of the citrus family, samang, casuarina, mesquite, banyan, bread-fruit, mango, &c.; various shrubs, such as roses, hibiscus, crotons, etc., in fact, nearly everything except eucalyptus, palms and sugar-cane. An experiment to infest the latter with *Icerya* failed on account of the arrival of the *Vedalia* shortly afterwards.

5. *What remains of the Icerya*.—Two boys who have been supplying my *Vedalia* cage with *Icerya* all along, told me on November 15, 1890, that no more of the food could be found anywhere. The boys have their own horses and were only too anxious to earn their 25 cents a day, but I knew from my own observations that they were correct and I gave up the cage. Since then some few of the *Icerya* have been noticed, but I don't think that they ever will become a pest again.

There is this, however, to be said: That for some months past nobody has seen a *Vedalia* here, and it would be impossible for me to-day to produce a specimen of this insect in any of its stages. During August and September last they were so abundant under many of the trees that one might have scooped them up with a shovel. The probability is that the *Vedalia* will make its appearance again shortly.—[A. Jaeger, Honolulu, December 26, 1890, to D. W. Coquillett.

List of Coleopterous Larvæ sent by C. V. Riley to F. Meinert of Copenhagen, for the University Museum, in exchange for European Specimens from the Schiödte Collection.

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|----------------------------------------------------------------------|--------------------------------------------------------------------------------|
| 1. <i>Calosoma externum</i> Say, young larvæ, Alabama. | 13. <i>Anatis 15-punctata</i> Oliv., larvæ and pupæ, Washington, D. C. |
| 2. <i>Amara obesa</i> Say, larvæ, Kansas. | 14. <i>Psyllobora 20-maculata</i> Say, larvæ, Michigan. |
| 3. <i>Galerita janus</i> , Fabr., larva, Washington, D. C. | 15. <i>Chilocorus bivulnerus</i> Muls., larvæ, pupæ, imago, Louisiana. |
| 4. <i>Hydrophilus triangularis</i> Say, young larvæ, Missouri. | 16. <i>Epilachna borealis</i> Fabr., larvæ, imago, Alabama. |
| 5. <i>Silpha inæqualis</i> Fabr., larvæ and pupa, Missouri. | 17. <i>Epilachna corrupta</i> Muls., larvæ, imago, New Mexico. |
| 6. <i>Adelops hirtus</i> Tellk., larvæ, Mammoth Cave, Kentucky. | 18. <i>Olibrus ergoti</i> (Walsh) Casey, larvæ, imago, Indiana. |
| 7. <i>Maseochara valida</i> Lec., larva, California. | 19. <i>Aphorista vittata</i> Fabr., larva, Washington, D. C. |
| 8. <i>Stilicus angularis</i> Lec., larvæ, Texas. | 20. <i>Stenotarsus hispidus</i> Herbst., larvæ, pupa, imago, Washington, D. C. |
| 9. <i>Olophrum obtectum</i> Er., larva and pupa, Washington, D. C. | 21. <i>Endomychus biguttatus</i> Say, larvæ, Tennessee. |
| 10. <i>Megilla maculata</i> DeG., larvæ and imago, Washington, D. C. | 22. <i>Triplax unicolor</i> Say, larvæ, pupa, Missouri. |
| 11. <i>Hippodamia convergens</i> De Geer, larvæ and pupæ, Missouri. | 23. <i>Erotylus Boisduvali</i> Chev., larvæ, New Mexico. |
| 12. <i>Coccinella 9-notata</i> Hbst., larvæ, pupa, imago, Indiana. | |

24. *Murmidius ovalis* Beck, larvæ, pupæ, (attached to kernels of rice,) Washington, D. C.
25. *Silvanus cassiæ* Reiche, larvæ, pupa, imago, Alabama.
26. *Hemipeplus marginipennis* Lec., larva, Florida.
27. *Mycetophagus obsoletus* Melsh., larva, pupæ, Washington, D. C.
28. *Carpophilus hemipterus* Linn., larva.
29. *Carpophilus dimidiatus* Fabr., larvæ, imago, South Carolina.
30. *Stelidota geminata* Say, larvæ, Missouri.
31. *Phenoliagrossa* Fabr., larvæ, Missouri.
32. *Psephenus LeContei* Lec., larvæ, New York.
33. *Macronychus glabratus* Say, larvæ, Michigan.
- 33½. *Nemosoma parallelum* Melsh., larvæ, Washington, D. C.
34. *Trogosita virescens* Fabr., larvæ, California.
35. *Alaus oculatus* Linn., larva, pupa, Florida and Missouri.
36. *Hemirhipus fascicularis* Fabr., larva, Missouri.
37. *Drasterius dorsalis* Say, (= *elegans* Fabr.), larvæ, Indiana.
38. *Agriotes mancus* Say, larva, imago, Indiana.
39. *Ludius hepaticus* Germ., half-grown larva, Florida.
40. *Melanotus communis* Gyllh., larva, pupa, imago, Indiana.
41. *Dicerca obscura* Fabr., larvæ, New York.
42. *Buprestis rufipes* Oliv., larva, Florida.
43. *Chrysobothris femorata* Fabr., larvæ, pupa, Missouri.
44. *Photinus pyralis* Linn., larva, Missouri.
45. *Photuris pennsylvanica* DeG., larvæ, Washington, D. C.
46. *Chauliognathus marginatus* Fabr., larva, New York.
- 46½. *Thanasimus dubius* Fabr., larvæ, Michigan.
47. *Ernobius granulatus* Lec., larva, Florida.
48. *Hemiptychus punctatus* Lec., larvæ, New Jersey.
49. *Vrilletta expansa* Lec., larva, California.
50. *Sinoxylon declive* Lec., larva, California.
51. *Psoa maculata* Lec., larvæ, California.
52. *Canthon lavis* Drury, larva, Missouri.
53. *Euparia castanea* Serv., larvæ, imago, Alabama.
54. *Polyphylla occidentalis* Linn., larva, New Hampshire.
55. *Chalepus trachypygus* Burm., larvæ, Georgia.
56. *Euphoria inda* Linn., larvæ, Washington, D. C.
57. *Allorhina nitida* Linn., larva, New Jersey.
58. *Parandra brunnea* Fabr., larvæ, New York.
59. *Elaphidion inerme* Newm., larva, Florida.
60. *Arhopalus fulminans* Fabr., larvæ, pupa, Washington, D. C.
61. *Neoclytus caprea* Say, larva, pupa, Kansas.
62. *Cyllene picta* Drury, larva, pupa, imago, Missouri.
63. *Rhagium lineatum* Oliv., larva, pupa, New Jersey.
64. *Steirostoma depressum*, larvæ, Surinam, South America.
65. *Liopus haldemani* Lec., larvæ, pupa, Georgia.
66. *Saperda calcarata* Say, larva, Kansas.
67. *Saperda vestita* Say, larva, Michigan.
68. *Saperda tridentata* Oliv., larvæ, pupæ, imago, Michigan.
69. *Tetraopes tetraophthalmus* Forst., larvæ, New Hampshire.
70. *Donacia piscatrix* Lac., larva, pupa, Michigan.
71. *Lema trilineata* Oliv., larva, imago, Missouri.
72. *Coscinoptera dominicana* Fabr., larva, pupa, Missouri.
73. *Graphops pubescens* Melsh., larvæ, Ohio.
74. *Doryphora 10-lineata* Say, larvæ, Missouri.
75. *Doryphora juncta* Germ., larvæ, Maryland.
76. *Chrysomela disrupta* Rog., larvæ, Texas.
77. *Lina scripta* Fabr., larvæ, pupa, imago, Pennsylvania.
78. *Gastroidea cyanea* Melsh., larvæ, pupa, Washington, D. C.

79. *Monocesta coryli* Say, larvæ, Missouri.
80. *Diabrotica longicornis* Say, larvæ, Missouri.
81. *Trirhabda tomentosa* Linn., larvæ, pupa, Missouri.
82. *Galeruca decora* Say, larvæ, Washington, D. C.
83. *Disonycha alternata* Ill., larvæ, pupa, Missouri.
84. *Graptodera chalybea* Ill., larvæ, New York.
85. *Graptodera foliacea* Lec., larvæ, Colorado.
86. *Dibolia area* Melsh., larvæ, pupæ, imago, New York.
87. *Microrhopala vittata* Fabr., larvæ, pupa, Washington, D. C.
88. *Cassida texana* Crotch, larva, Texas.
89. *Coptocycla aurichalcea* Fabr., larvæ, Virginia.
90. *Chelymorphus argus* Licht, larvæ, Iowa.
91. *Bruchus obsoletus* Say, larvæ, pupa, imago, Indian Territory.
92. *Scotobates calcaratus* Fabr., larva, Washington, D. C.
93. *Diaperis hydni* Fabr., larvæ, imago, New Jersey.
- 93½. *Hypophlæus parallelus* Melsh, larvæ, imago, Michigan.
94. *Platyedema ellipticum* Fabr., larvæ, pupa, imago, Washington, D. C.
95. *Bolitotherus bifurcus* Fabr., larva, Massachusetts.
96. *Hymenorus rufipes* Lec., larva, Washington, D. C.
97. *Synchroa punctata* Newm., larvæ, Missouri.
98. *Penthe pinelia* Fabr., larvæ, Michigan.
99. *Oxaxis dorsalis* Melsh., pupa, Florida.
100. *Mordella 8-punctata* Fabr., larva, Missouri.
101. *Hornia minutipennis* Riley, triungulin, Washington, D. C.
102. *Aramigus fulleri* Horn, larvæ, pupa, New Jersey.
103. *Pissodes strobi* Peck, larvæ, Washington, D. C.
104. *Lissorhoptrus simplex* Say, larvæ, Georgia.
105. *Authonomus grandis* Gyllh.?, larvæ, pupa, imago, Mexico.
106. *Magdalis armicollis* Say, larvæ, pupa, imago, Michigan.
107. *Conotrachelus nenuphar* Herbst, larvæ, Ohio.
108. *Tyloderma foreolatum* Say, larva, pupa, Indiana.
109. *Chalcodermus æneus* Boh., larvæ, Florida.
110. *Balaninus nasicus* Say, larvæ, Washington, D. C.
111. *Centrinus picumnus* Herbst, larvæ, Indiana.
112. *Rhynchophorus cruentatus* Fabr., larva, Florida.
113. *Scyphophorus yuccæ* Horn, larva, pupa, California.
114. *Sphenophorus robustus* Horn, larva, pupa, California.
115. *Eupsalis minuta* Drury, larvæ, pupa, Missouri.
116. *Scolytus 4 spinosus* Say, larvæ, pupæ, Missouri.
117. *Phlæotribus liminaris* Harris, larvæ, New York.
118. *Phænicobius chamæropis* Lec., larvæ, Georgia.
119. *Sinoxylon basillare* Say, larvæ, imago, Washington, D. C.
120. *Litargus tetraspilotus* Lec., larvæ, West Virginia.
121. *Mordellistena floridensis* Smith, larvæ, pupa, imago, Florida.
122. *Tenebrio tenebrioides* Beauv., larvæ, imago, Michigan.
123. *Disonycha collaris* Fabr., larvæ, Michigan.
124. *Paratenetus punctatus* Sol., larvæ, imago, Washington, D. C.

Eggs of the American Meromyza: a Correction.

Kindly allow me space in your journal for a correction of the proceedings of the Entomological Club of the American Association for the Advancement of Science, as reported in Vol. III, No. 2, of INSECT LIFE.

I am made to say that according to my experience the eggs of *Meromyza americana* are placed above the ensheathing parts of the blades of wheat. What I did state was, that I had very generally found them *upon* the ensheathing parts, not above.

Following the reading of Professor Osborn's paper on insect diseases, some one stated that experiments were under way looking to the destruction of the Boll Worm by means of the bacteria which accompany a disease of larval *Pieris rapæ*. Without giving my reasons in detail, I stated that this disease did not seem to me a promising one for the purpose, and suggested that diseases which affect the Forest tent caterpillar (not the "Tent caterpillar"), or the striped cut worm, might prove more available. In justification of this opinion I may now add that with a good deal of experience with the disease of *P. rapæ*, in the laboratory and out, I have yet to see an unquestionable instance of the transfer of the disease to another species. Here at Lexington the two species, *P. rapæ* and *P. protodice*, are about equally common and occur together. A field in which fully 75 per cent. of *P. rapæ* were affected was under close observation during the past summer, and not a case of the disease in *P. protodice* was observed. With the dead larvæ of *P. rapæ* abundant in the cabbage, and their fluids constantly spread over the leaves by dews and rains, a better test, on a large scale, of the communicability of this disease could scarcely have been devised. Applied to the case of the Boll Worm this is negative evidence, but none the less worth considering where it is important to get prompt returns for labor.—[H. Garman, Lexington, Ky., November, 1890.]

Beetles and Moths infesting Stored Corn in Venezuela.

I take the liberty of forwarding by mail a small insect which causes great damage to Indian corn when shelled and warehoused, with the request that it be examined and given its proper designation. This insect attacks the ripe corn after being shelled and stored and causes great fluctuations in the market price, and from this cause alone the cereal in question has frequently risen from \$1 to \$9 or \$10 per "fanega" (240 pounds).—[E. H. Plumacher, U. S. consul, Maracaibo, Venezuela, August 11, 1890.]

REPLY. The insects prove to belong to the following species:

Calandra oryzae L., *Echocerus maxillosus* Fab., *Trogosita mauritanica* L., *Tribolium ferrugineum* Fab., and one of the grain moths, *Ephestia* sp., of which a few specimens were found, but all too badly damaged to be specifically determined. The first four insects mentioned are cosmopolitan beetles and infest stored grain the world over. The first mentioned, *C. oryzae*, was by far the most abundant in the sample sent and doubtless causes the major part of the injury. A closely allied insect, *Calandra granaria*, also widely distributed, has been reported to be very injurious to stored grain in Chili and doubtless also occurs with you.

The larva of the *Trogosita* is now doubtfully supposed to be carnivorous in habit and to feed on the larvæ of other insects. It was long supposed to feed on the grain, and its carnivorous nature is still somewhat of a mooted question. The habits of the other three beetles are similar. The early stages and also the adult forms feed on the grain, as does also the adult of the *Trogosita*.

The species of *Ephestia* is either *E. kühniella* or *E. interpunctella*, both well known grain pests. It will be very desirable for you to send us additional samples of the grain, containing, if possible, the larvæ and pupæ of this moth, so that the species can be positively determined. The matter is one of considerable interest as it may throw some light on the origin of the so-called Mediterranean Flour Moth (*Ephestia kühniella*), which is still in doubt.

No complete remedy for these insects has yet been devised, although considerable effort has been made in this direction both in this country and Europe. Preventive measures of value consist in maintaining the utmost cleanliness about granaries, in keeping the walls freshly whitewashed, and in shifting the grain from time to time.

Of the direct remedies the most satisfactory and available one is the use of bisulphide of carbon, which may be satisfactorily employed if the grain is kept in tight granaries and bins. After all the cracks have been closed as tightly as possible, an

open vessel containing the bisulphide of carbon should be placed on the grain. This substance is extremely volatile, and the vapor is heavier than air and will permeate the entire mass of grain. Great care must be taken in the use of this substance, as it is extremely inflammable. The carbon bisulphide does no harm to the grain whatever and the odor is soon lost upon airing, and experiments seem to show that the germinating power is not affected by its use. If the grain can be tightly inclosed for this experiment the amount necessary is small, not more than $1\frac{1}{2}$ pounds to each ton of grain being required. Of course in more open bins or cribs a larger amount will be necessary, and the application will have to be repeated at much shorter intervals.

Naphthaline and benzine may also be employed, and as the latter is also highly inflammable, the same precautions are necessary in its use as with the bisulphide. Its action is somewhat slower and larger quantities will need to be used. It will be best to place the naphthaline powder or benzine at the bottom of the bin or bulk of grain. This can be accomplished by the use of tubes. In India hollow bamboo rods are used for this purpose. The naphthaline acts as a repellant, and also has insecticide properties. Benzine acts in the same way, and its insecticide value is much greater, but is inferior to the bisulphide. The use of naphthaline, however, is objectionable, because it gives a more or less permanent odor to the grain.—[Oct. 14, 1890.]

Sweet Potato Root-borer.

I inclose you in a small tin box some pieces of sweet potato and the bug and worm that has destroyed our sweet potato crop for 3 years in this neighborhood. The bug or worm goes down the vine from above the ground. I find a small hole down through the middle of the vine into the potato. If there is any way to destroy this bug which the Department knows of, it would be a great blessing to this community.—[T. H. Edwards, Bay View, Harris County, Tex.]

REPLY.—The insect in question is known as the sweet potato root-borer (*Cylas formicarius*). This insect is treated in the report of the Entomologist, in the annual report of this Department for 1879, page 249. It is a widely distributed insect and has been reported from China, India, Madagascar, Cuba, Louisiana, and Florida, and was doubtless introduced into the United States through Cuba. The early stages are passed in the sweet potato, the eggs being deposited in cavities eaten out by the parent beetles. The larvæ burrow in the root in all directions. When full grown the pupal state is assumed in cavities near the end of the larval burrow and the mature beetle on emerging continues to feed on the potatoes. No remedy has been suggested except the one given in the report cited, which is to dig the potatoes as soon as they are found to be infested and feed those containing insects to stock.—[October 13, 1890.]

The Whip-tail Scorpion.

Yours of the 3d instant duly to hand. In reply will say I am very cautious not to handle the Whip-tail Scorpions with my bare hands. I have never seen the eggs. I found the young specimens under the rain tubs, old wood, etc. They generally have a hole they hide in when I look for them, but dig them out. I often smell the acid odor you mention when I find the large old ones. On one occasion several years ago I was holding one on a large chip, taking a good look at him, when he ejected a stream at least a foot upwards, and it fell upon my sleeve about the elbow. I was afraid it would go into my face. I was very careful that he did not turn the hose on me any more. That was the only time I ever saw that operation, and I have handled dozens of them. I do not know if that is one of their means of defense, or whether it was just accidental that it so happened. People here mostly are afraid of them. The colored man I referred to in a former letter was the first person I ever heard of that took them in the hand. He said he saw some one handle them, but was afraid of them himself. Some say they apply the poison with the tail after cutting with the big

claws. I am glad the specimens arrived in as good order as they did. I would like to know if they are really poisonous or hurtful. If you should wish any more I can furnish them to you. We have plenty of the common Scorpions—stinging kind. I saw an old one with six or eight young ones on her back, riding them around. My wife was stung several times with these. It is like a wasp sting only.—[Dr. L. B. Rowland, Silver Springs Park, Marion County, Fla., October, 1890.]

Horse flies in Texas.

I have specimens of the insects mentioned in my last letter. The little fly that bites the horses' ears you will find in the cap box; I captured two of them. They were so gorged with blood that they rotted in two days, but perhaps you will recognize them. In the same box you will find flies that bite the horses' legs and belly; you will perhaps notice two different kinds of these small flies; the one with the green eyes bite the belly and the gray-eyed ones the legs; you will also find another big black fly which looks different from the one I sent you before. In that bottle you will find the gray *Tabanus* and the green-eyed one, also some Hymenoptera. In the square bottle you will find some beetles. The beetles come in at the window at night, but the flies I captured on the horses. [F. W. Thurow, Hockley, Harris County, Tex., June 20, 1890.]

REPLY.—The specimens have been determined as follows:

Chrysops vittatus Wied. is the species mentioned in your former letter and also inclosed in your last letter.

Chrysops sp. is the little fly which bites the ears of horses. It is too badly damaged to determine specifically.

Tabanus lineola and *T. costalis*? are the gray-eyed flies which infest the legs of the horses.

Tabanus sp. is the green-eyed fly mentioned. It is too badly injured to be determined.

Tabanus americanus is the large black fly.

Tabanus molestus? is the gray fly.

Chrysis sp. is the Hymenopteron, also too much injured to be further determined.—[June 26, 1890.]

A Borer in a Tree Fungus.

I send you by mail to-day what may be a peculiar study of insect life, a piece of fungus growth which I secured for the purpose of painting thereon a landscape. While standing on a mantel awaiting the convenience of the artist, the holes you will find in it appeared, evidently spoiling it for artistic effect. I noticed about them a number of minute flies but no larva, but a few days ago I detected the operation of some individual inside. I have closed up the holes and send it to some one better able to investigate than self. I don't know that it will be new or interesting but concluded no serious harm would be done by forwarding it to you.—[T. P. Henderson, Hulton, Pa., September 3, 1890.]

REPLY.—* * * This fungus of the genus *Polyporus* has been bored by one of the common fungus beetles known as *Boletotherus bifurcus*. It is a common insect, but is seldom noticed except by those who are searching for it. Careful examination of the fungus sent shows three living beetles, but no larvæ or pupæ.—[September 4, 1890.]

Migration of *Callidryas eubule*.

I send you inclosed a butterfly that has been attracting a great deal of attention in this part of Alabama.

They are flying over our country by millions, from a northwesterly direction in a southeasterly course. When they come to trees or houses they rise gradually and fly over them. They light but for a short time on leaves and flowers and then hasten

onward. What is the name of this butterfly? What is the worm called? Upon what does it feed?—[John M. Davis, Fayette Court-House, Alabama, September 12, 1890.]

REPLY.—The butterfly which you send is known as *Cullidryas eubule*, and we are very glad to get your note upon the migration of this species. It feeds upon the different plants of the genus *Cassia*, the most common of which in your vicinity is, I believe *C. grandiflora*.—[September 16, 1890.]

The Brassy Flea Beetle injuring Corn.

Inclosed you will please find an envelope in which are some insects which I will call the corn flea. They have infested the corn in this locality pretty generally the present season. It attacked the plant when not more than two blades high, and has kept at work on it all the season up to the present time. As the corn grew they seemed to increase in numbers until there would be as many as a dozen or more to the blade.

It keeps on the underside of the leaf most of the time and will jump if disturbed in the least, and sometimes will jump at the mere approach of a person. From this habit, it seems to have escaped the notice of nearly every farmer until his attention is called to it. I have asked a number what they thought was the cause of the blight of the corn blades, and, with but one exception, they have attributed it to the dry weather, until their attentions were called to the little pest. I also inclose a corn blade that you may see the effect as it appears. Can you tell who the little stranger is, and something of his history and habits?—[J. J. Baldwin, Westfield, Ind. October 6, 1890.]

REPLY.—The little insect which you call the "corn flea" is known to entomologists as the Brassy Flea Beetle (*Chetocnema pulicaria*). This insect is often observed feeding as you describe it both upon corn and grasses, but its life history is not known nor has it ever been reported in sufficient numbers to make it worth while to look into the matter of remedies.—[October 10, 1890.]

The Banded Sand Cricket.

Having discovered the "missing link" which connects the Crustacea with the Orthopterous insects, I send it to you to-day by mail in a tin box. Some one left this insect for me at my office, and as yet I have been unable to say where it was captured. It is safe to conjecture, however, that it was found at Miles City or vicinity about September 28, 1890, as it was alive and in an open tin can when I arrived at my office. Never having seen this insect before, I write to ask what it is?—[C. A. Wiley, Miles City, Montana, September 29, 1890.]

REPLY: The insect which you send is a specimen of the Banded Sand Cricket (*Stenopelmatus fasciatus*). This insect is found not uncommonly under stones and in a loose soil from Idaho to the Pacific coast and southward. It is carnivorous, feeding upon other insects, and in the Southwest is greatly feared by the Mexicans, who consider its bite to be extremely poisonous. This is, however, unquestionably a mistake, and probably arises from the fact that Arachnids of the poisonous genus *Galeodes* somewhat resemble these sand crickets and are found in similar locations. With regard to your suggestion that this species forms a connecting link between the Crustacea and the Orthoptera, I may state that it belongs to the Orthopterous family *Locustidae*, which includes the long-horn grasshoppers, the katydids, and the stone crickets.—[October 4, 1890.]

A curious Bedbug find.

Referring to page 21, Vol. III, the article on bedbugs in unusual places reminds me of a find made by myself some time ago late in October. Passing a swamp, I saw some cat-tails in the distance, which I procured after some tall wading. What was my surprise, after placing them in the carriage, to find the heads of each spike crammed

with bedbugs; leastwise the woman said they were such, as they looked and smelt like them. But the mystery to me was, how on earth did they get there, a mile from any house, and in the midst of a pond, always known to be full to the banks with water. Perhaps they crossed in the winter on the ice. At all events, as the poet says, "They got there all the same." [Dr. E. Sterling, Cleveland, Ohio, September 26, 1890.]

REPLY. It is altogether probable that the bug which you found upon the reeds was a different species although resembling the bedbug. * * * —[September 27, 1890.]

The poisonous Spider of Australia.

Mr. G. B. Federli, viticultural expert, writes: "I made inquiries about the bites of the *Lathrodictus*, and the following information will very likely be of some interest to you. T. W. Taylor, a miner, residing at Wooragee, Beechworth, was bitten by the *Lathrodictus* on the first joint of the first finger. Immediately afterward a darting, painful sensation, followed by rapid swelling and severe pain, were experienced. He applied to a doctor, who amputated the first joint of the finger. The Italians, who are working in the bush at Chiltera and elsewhere, I am told, in the case of bites of the *Lathrodictus* or by the bull-ant, apply at once soft earth, with a preference for black soil, if close at hand, and I am assured with successful results."

Mr. C. McPherson, of Shepparton, who was bitten by one of these spiders in the foot, says: "At first it is just like the prick of a pin. Then for a time the pain increases until it becomes unbearable and excruciating. The time I was bitten was about 4 o'clock in the morning. The spider evidently fell from the ceiling. I was bitten on the toe and suffered for about 4 or 5 hours. A chemist gave me a prescription that stopped the pain. After the pain ceased perspiration broke out right up the calf of the leg."

"I know a man who was bitten in a closet and suffered for some weeks. He ran about like a mad person. Mrs. Dennis, of Cosgrove, was bitten on the finger, and a doctor scarified the joint."

"The spiders take up their abode in deserted houses, sometimes in the walls or ceiling of unoccupied houses. They frequent outhouses."

"I have known some cases where symptoms of the pain have reoccurred at regular seasons."—[C. O. Montrose, Shepparton, Victoria, Australia.]

Notes from Mississippi.

The Cabbage Pionea (*Pionea rimosalis*, G.).—This worm has been more numerous than last season, and has been more destructive as a garden pest than any of the other worms named below.

The Cabbage Plusia (*Plusia brassicae*, R.).—Quite abundant in every garden in this locality, doing some injury.

The Southern Cabbage Butterfly (*Pieris protodice*, B.).—Not as injurious as the above-named worms.

The Greasy Cut-Worm (larva of *Agrotis ypsilon*, R.).—More numerous than last season; very destructive in all gardens during April and May to young cabbage and tomato plants.

The Tomato Worm (*Sphinx quirkemaculata*).—This worm has been quite numerous and very damaging to tomato vines and its fruit. Captured one specimen well supplied with little cocoons of *Apanteles congregatus*, like Fig. 73, page 105, Bulletin Agricultural Experiment Station of Nebraska, Volume III, Article No. 2.

The Striped Cucumber-Beetle (*Diabrotica vittata*).—Very damaging to squash and cucumber vines; also observed feeding upon bush beans.

The Squash-Vine Borer (*Melittia ceto*, W.).—Very injurious to squash, cucumber, and cashaw vines.

The Melon Worm (*Phakellura hyalinatalis*, L.).—Very destructive the past season, eating cavities into melons, cucumbers, and cashaws; also devouring their foliage.

Proconia undata. Found specimens feeding on okra during August.

The Celery Worm (*Papilio asterias*, C. j.).—This is the first season I observed this caterpillar in this locality, feeding on parsnips and carrots in large numbers.

The Boll Worm, (*Heliothis armigera*, H.).—Reported from every district in this county as the chief enemy known to cotton this season; its damage will reduce the yield fully two-fifths. The general injury to the corn crop is not as great as common.

The Corn-root Worm (*Diabrotica 12-punctata*).—The larva of the same very destructive to young corn plants during April.

The Granulated Cutworm (larva of *Agrotis annexa*).—Reported from all parts of this county quite numerous and very destructive to young cotton plants during April and May.

The Tobacco Worm (*Sphinx carolina*).—Very common, as usual.

The Garden Web-worm (*Eurycreon rantalis*, G.).—Quite numerous on cotton and sweet-potato vines, injuring the same to some extent.

The Spotted Grapevine Beetle (*Pelidnota punctata*, F.).—This insect doing some damage to grapevines, but are yet in limited numbers in this locality.

The *Satellite Sphinx*.—This insect found feeding on grapevines during June and July.

The Grape-leaf Folder (*Desmia maculalis*).—Very numerous and destructive to grapevines this past season.

The Common Yellow Bear (*Spilosoma virginica*).—Doing some injury to grapevines.

The Yellow-necked Apple-tree Caterpillar (*Datana ministra*) observed in large numbers on apple trees in this locality.

The Fall Web-worm (*Hyphantria cunea*, D.).—This insect has been more numerous than common, defoliating a great number of trees in this county, chiefly amongst them the following: Apple, pear, plum, crab apple, wild plum, pecan, persimmon, mulberry, sweet gum, black or sour gum, sycamore, sourwood, black locust, shell-bark hickory, and also observed them devouring cotton plants.

The White-marked Tussock Caterpillar (*Orgyia leucostigma*, S.).—Captured several specimens defoliating apple trees.

The Green-striped Maple-worm (*Anisota rubicunda*, F.).—This caterpillar stripping the foliage of maples in this county to some extent.

The Catalpa Sphinx (*Sphinx catalpa*, B.).—Quite numerous and destructive to the foliage of every tree in this locality.

The American Silkworm (*Anthera polyphemus*, L.).—This insect found feeding on the foliage of several forest trees in this county.

The Antiopa (*Euvanesa antiopa*, L.).—This caterpillar has been quite numerous in this section of our county, feeding chiefly on the foliage of the slippery-elm tree.

The yellow and black Swallow-tail Butterfly (*Papilio turnus*, L.).—This insect has been numerous and very damaging to some forest trees.

The Cottonwood Leaf-beetle (*Lina scripta*, F.).—Quite numerous and destructive to the Cottonwood in this county.

The Twig Girdler (*Oncideres cingulatus*).—Very common on hickory, pecan, and persimmon trees. [Geo. H. Kent, Roxie, Miss., September 20, 1890.

Carnivorous Habits of Locusts.

Is it common for the locusts to be carnivorous? Yesterday in picking off some Zebra caterpillars from cauliflowers in my garden I noticed a common red-legged grasshopper whose actions arrested my attention. Examining him I found he was eating an insect. He was so occupied he allowed me to take him up in my hand when I saw that he was chewing away at the abdomen of the striped bug, such as eats cucumber vines. Replacing him on the plant he completed his meal, leaving nothing but the wings. This was a surprise to me, as I supposed all the grasshoppers were strictly vegetarians. I have noticed that the common fire-fly is carnivorous.—[George L. Clark, Boston, Mass., October 1, 1890.

REPLY.—It is not common for locusts to be carnivorous, but instances such as that which you mention are occasionally observed not only with locusts but with other plant-feeding insects.—[October 2, 1890.]

Citheronia injuring Cotton.

I send you a worm that has this year for the first time made its attack on the cotton plant. Please examine him and tell us something about him and what we are to expect from him in the future. He has destroyed considerable cotton plant in some places. He attacks and eats the plant much the same as the small cotton worm does, only he eats stalk as well as leaves —[D. C. Scarborough, Natchitoches, La., October 2, 1890.]

REPLY.—The caterpillar which you send is the so-called Royal-horned Walnut caterpillar, and is the larva of a handsome moth known as the Regal Walnut moth (*Citheronia regalis*). This caterpillar has been recorded as feeding upon quite a variety of trees and shrubs, among them walnut, hickory, butternut, persimmon, and sumach, but so far as known it has never been recorded as feeding upon cotton. It is a comparatively rare species and has never been recorded in sufficient numbers to do any appreciable damage. Its large size and brilliant coloration render it easily seen, and the few which will be found upon cotton plants may be killed by hand without taking any other precautions.—[October 6, 1890.]

Gelechia cerealella in Virginia.

We send with this sample of wheat raised in Virginia near Gunston which has a new kind of a bug in it to us. At first we thought it was the black weevil, as it eats out the heart of the grain, but as you see it produces a fly. We are finding it in a large number of samples offering, but have never had quantity enough to tell how it will affect the flour, or if the grain will heat if in bulk as weevil will do.—[W. H. Tenney & Sons, Georgetown, D. C., September 18, 1890.]

REPLY.—The pest is the Angoumois grain-moth (*Gelechia cerealella*). You will find an account of this insect in the annual report of this Department for 1884, pages 345 to 355, which contains a digest of the information which we have concerning it. We are not informed as to whether the grain will be more apt to heat in bulk if attacked by this insect. The quality of the flour, however, is unquestionably damaged by its presence in numbers, and it will pay you to adopt stringent measures to prevent this insect getting a foothold in your mills. The best method of destroying it will be to quarantine all infested grain in tight bins and disinfect it by means of the carbon bisulphide treatment. Of this substance not more than 1½ pound to a ton should be used.—[October 7, 1890.]

Appearance of wheat infested with Hessian fly.

* * * In my report on Hessian fly I shall deal with the effect of larvæ on young plants. I think you have never quite agreed with me as to the appearance of affected plants. I send to-day two boxes, one of injured and one of healthy plants. Now I have not myself touched these, but Professor Plumb went to the field with me, dug up what I told him to. I send these, *A* being infested and *B* healthy plants. This is pure guesswork. I want you to look these over and tell me the result. How many mistakes have I made?—[F. M. Webster, La Fayette, Ind., September 20, 1890.]

REPLY.—Of the lot *A* (infested plants) 37 were infested and 1 was healthy. Of the lot *B* (healthy plants) 6 were infested and 35 healthy. The difference in the general color of the two lots is quite marked but I strongly suspect that the common wheat rust has something to do with this, since the yellowing of the less infested plants is evidently due to the greater abundance of rust on them than on the plants more attacked by Hessian fly. * * * The stooling or fasciation of the plants is just what one would expect, as this tendency to stooling is the common result of any

influence which depletes or checks the growth of the plant. An interesting question arises in this connection, namely, whether a mild attack of Hessian fly may not be an actual benefit, because I believe that effective stooling is a desideratum in all winter wheat regions. At least it used to be so in my farming days, and the policy of sowing thin rather than thick was based upon the tendency to stool. I believe that two months hence, or during the winter season, the appearance of the plants badly infested and those but little affected by Hessian fly will be totally changed; *i. e.* the badly infested field will be much more yellow in appearance than the non-infested. This is what I meant, and what has probably led you to believe that I did not agree with you in the appearance of affected plants. It will be very interesting to have this experiment repeated, of Professor Plumb's choosing, in a field not affected by rust. In such case you would have to depend entirely on the greater tendency to stooling of the infested plants, and not be guided very much by color. Is this not so, or do you claim that the work of the Hessian fly, in addition to causing the stooling, also induces a darker color of leaf?—[September 24, 1890.]

House-fly Parasites.

* * * Inclosed you will find some common house flies which are infested with parasites. I first discovered them last season and not infrequently find a fly upon which I can count a dozen with my naked eye, and, as soon as the fly is killed, they walk off briskly on their six legs. It has been a matter of remark that flies are scarce this year and can it be possible that these mites are decimating the pests?—[Miss Sarah Parker, Gouverneur, St. Lawrence County, New York, September 22, 1890.]

REPLY.—* * * The mites which you found upon the common house fly are the young forms of the species which Professor Riley described in the first report of the United States Entomological Commission as *Trombidium muscarum*, and it is very common in this country as well as in Europe, where the larval form was previously described as *Astoma parasiticum* by the French entomologist Latreille. This six-legged form which you have noticed is a larval form. After leaving the fly it crawls away and sheds a skin, coming out as a reddish colored eight-legged mite.—[September 25, 1890.]

Night Swarming of Lace-wing Flies.

Inclosed you will find an insect that has fairly taken possession of our little islands. It works in the night, and at daylight hides in cracks and out of the way places where the sun's rays do not penetrate. * * * [James J. W. Doyles, first assistant keeper, Cape Flattery Light Station, Washington, Aug. 30, 1890.]

REPLY * * * The matter proves to be one of considerable interest, as the insect is one of suspected abnormal habits. It is one of the lace-winged flies and is known as *Polystachotes punctatus*. While the majority of the insects of this family are air-breathers in their larval states, it has been suspected that the larvæ of this creature are aquatic, but in all of them the larvæ are predaceous and carnivorous and as they feed very little or not at all as adults, they are beneficial rather than injurious insects. If the supposition concerning this species is correct, it should be breeding in great numbers in some fresh-water stream or pond near your light, or possibly at some distance, as they are strong fliers. It is a matter which would be very interesting to investigate as they are present in such large numbers, and it seems that with careful watching you ought to see the females lay their eggs. It ought not to be much trouble to watch the eggs hatch, and thus ascertain the habits of the larva. The place of oviposition would indicate a good deal.

We should be very glad to have you look into the matter a little and to report any observations which you may make.—[September 11, 1890.]

GENERAL NOTES.

RECENT PAPERS ON EUROPEAN GRAPE INSECTS.

Our energetic and enterprising friend, M. V. Vermorel, the founder and owner of the Viticultural Experiment Station at Villefranche, France, which we visited last year, has just published the first two numbers (in one volume) of a new quarterly journal * devoted to viticulture. The volume is almost entirely taken up by two excellent entomological papers. The first is entitled "Contributions à l'étude du Gribouri," by E. Dupont, and gives careful original observations on the oviposition and larval injury of *Adoxus vitis*, a Chrysomelid beetle which is very injurious to the grape in Europe, and which occurs also in the boreal portion of North America. A colored plate illustrates the egg and the young larva, while two other plates illustrate contrivances to observe the working of the larva on the roots of living plants. The second paper is a very complete monograph of "La Cochyte" which is a Tortricid moth (*Cochylis ambiguella* Hübn.), and next to the Phylloxera perhaps the most important grape insect in France. The chapter on the various remedial measures is especially full and will be found of great interest to our own economic entomologists, although the insect itself fortunately does not occur in North America. Three well executed colored plates illustrate the various stages of the *Cochylis* and the work of the larva on the blossoms and berries.

CODLING MOTH LEGISLATION IN NEW ZEALAND.

During the past two or three years there has been a great deal of talk in New Zealand with regard to instituting some legislation against the Codling Moth and several acts have been proposed in the house of representatives. So far as we know, however, no actual laws are yet enforced. In the *New Zealand Farmer* for August 18, 1890, we notice that Mr. Wight has published some very pertinent criticisms on the proposed legislation. He shows that the marked differences between the Phylloxera and the Codling Moth consists in that with the latter insect the tree is not destroyed nor even injured, and that there are many remedies by which the insect may be killed. With the Phylloxera, therefore, severe measures are to be employed, while with the Codling Moth too severe measures will lead to unnecessary loss and to no ultimate good results. As a rule orchardists may be trusted to look after their orchards, requiring only protection from their careless neighbors. Mr. Wight seems to think that these latter should not be fined, but that some working gardener should be induced to go into the business and should be permitted to spray trees with Paris green at a fixed rate. The owners of the trees would soon find that the value of the apples saved

* Revue Trimestrielle de la Station Viticole de Villefranche (Rhône), 1890, Nos. 1-2.

would so far exceed the cost of spraying that no one would neglect the opportunity and very little compulsion would be necessary. With improvident orchardists, and even with others, the cost of the appliances, the lack of time to use them, the lack of knowledge as to actually what to do is the main trouble. The proposed inspectors should simply have to see that the trees were sprayed at the proper time. Mr. Wight holds up to ridicule the suggestion that heavy fines should be imposed upon the giving away, selling, or otherwise disposing of diseased apples. He shows how impossible it is to exterminate the insect and how universally it is carried about in articles of import. He has seen a larva carried over 100 miles on the leg of a pair of trousers, and shows how it is sent in packages of groceries and in cases of hardware and other articles of trade. He calls attention to the important point that there is no clause in the last proposed act to protect mere tenants for short terms. He shows that there are a great many orchards that have been let to tenants on short leases and that many of these orchards have become badly infested before the present occupants were tenants. The result of the last proposed act then would be to place upon the shoulders of tenants the whole expense of cleaning another man's trees, and even in some cases where their term of occupancy would cease before the next crop is harvested. He mentions one case where it would cost more than the trees were worth to cure them and where the tenant would not have have been in occupation to receive a single apple resulting.

FEEDING HABITS OF THE BEE MOTH.

A dispute regarding the feeding habits of the Bee Moth (*Galleria cereana*) has arisen between Messrs. George Balding and C. G. Barrett (see *Entomologists' Monthly Magazine*, vol. 26, 1890, pp. 19-20, and 157), the former believing that the larva feeds as freely on new as on old comb, the latter asserting that it attacks only old comb. From our own observations we think there can be no doubt that neither is wholly right or wholly wrong, as the age of the comb does not affect the *Galleria*'s work so much as the strength of the colony, which is apt to be least vigorous when the comb is old.

TINEID MOTHS WITH PIERCING OVIPOSITOR.

As a most interesting result of careful observations, Mr. J. H. Wood announces in the *Entomologists' Monthly Magazine* for June, 1890 (pp. 148-150), that in certain species of the genus *Micropteryx* and in other genera (Mr. Wood only mentions *Incurvaria* by name) the female "lays her eggs like a sawfly, within the substance of the leaf." The oviposition in *M. semipurpurella* was watched by Mr. Wood, and when the leaf was examined "it was seen that a small incision had been made on the under side, which led to a rather deep oval chamber or pocket, at the bottom of which the egg lay." For a description of the intricate piercing apparatus the reader is referred to Mr. Wood's description. It suf-

fices to say here that the cutting instrument proper resembles a surgeon's lancet, the two edges of which are armed with a saw, and that the modification of the typical Lepidopterous ovipositor is in the same lines as shown by us in *Pronuba* and *Prodoxus*. The sawing or piercing ovipositor is more common in *Microlepidoptera* than is generally supposed.

ALTERATIONS IN THE FORM OF PLANTS DUE TO COCCIDÆ.

On this subject Mr. W. M. Maskell has an interesting article in the November, 1890, number of the *Entomologist's Monthly Magazine*. After stating that the great majority of Coccids do not materially alter the form of the plants they infest, he discusses briefly the few species that are known as gall makers. The usual explanation that these galls are produced "by irritation of the tissue consequent on the suction of the plant juices through the rostral tubes of the insect" Mr. Maskell thinks insufficient, for the reason that, since all Coccids work in precisely the same way, the absence of galls in the majority of species is not accounted for. More space is devoted to the "burrowing" Coccids, *i. e.*, those species which produce on the leaves or twigs they infest shallower or deeper cavities, until we come to such species as are more or less completely buried in the substance of the leaf or the bark. Since most of these burrowing species are apodous, the legs can play no part in producing the excavations, nor is it known that Coccids secrete any acrid or acid fluid. The explanation that the excavations "are merely due to the increasing growth of the insect, which, passively as it were, prevents the growth of the plant from filling up its usual form," would seem to be most plausible if the excavations occurred only on young and soft leaves or twigs; but since they occur also on the harder and older leaves of bark, Mr. Maskell is inclined to admit that "the action of the Coccid is not merely one of passive obstruction but one of active excavation." We should argue here as we have done in discussing the same subject in Aphids, which produce galls or other deformations of plant tissue, that a poisonous principle must exist, however difficult to detect.

INSECT INJURY TO BARREL STAVES.

An interesting case is reported in the September number of the *Kew Bulletin*, in which some barrels which were shipped to Calcutta from the Indian store department were found on their arrival at Calcutta to have been spoiled, owing to the work of some insect in the staves. A question arose as to whether the casks were unsound when they were shipped from England, or whether they were attacked on board ship on the voyage out, and we can readily imagine that litigation would have arisen had this been a private matter rather than one of government concern. The circumstance was investigated by Mr. W. F. H. Blandford, lecturer on entomology at the Indian Civil Engineering College,

at Cooper's Hill, who ascertained that the insect producing the damage was a Scolytid beetle—*Trypodendron signatum*—a European species that feeds in oak, birch, beech, and hazel. The borings of the beetle must have been already commenced at the time of the construction of the casks, and the latter were unsound when filled with beer; and further, the injury received by insects on board ship has nothing whatever to do with it. In other words, had this been a commercial case, the shippers of the beer would have been responsible, and they could have recovered from the makers of the casks.

COCAINE FOR INSECT STINGS.

The city of Srinagar, in Garwal, East India, swarms with scorpions, and people often get stung by them. From a note in Hardwicke's *Science Gossip* for November, 1890, we learn that Assistant Surgeon H. D. Tait, of that city, successfully uses cocaine hydrochlorate as a remedy. A hypodermic injection at or near the wound of one-half to one grain of cocaine in ten to fifteen drops of water is said to immediately stop the pain, with no subsequent inflammation.

DERMESTES VULPINUS DAMAGING WOODWORK.

Another instance of injury to woodwork by this Dermestid beetle (the natural history of which was given by us in the *Agricultural Report* for 1885, pp. 258–264) was recently brought to the knowledge of the members of the London Entomological Society by Mr. W. H. F. Blandford, at the meeting held October 1, 1890. In this case the insect damaged the roof of certain soap works near London, England, where it had no doubt been introduced with bones and fat.

BIRDS PREYING UPON THE WALNUT CATERPILLAR.

In the *Journal of the Columbus Horticultural Society*, vol. v, No. 3, September, 1890, is published an article by Mr. E. V. Wilcox, read at the August meeting of the Society, upon this subject. He mentions the fact that he observed the Yellow-billed and Black-billed Cuckoos, the Red-headed Woodpecker and the Blue Jay feeding upon the larva of *Datana angusii*. His observations were made in the vicinity of Columbus and he noticed that where the Cuckoos destroyed their thousands the Blue Jays destroyed their tens of thousands. He noticed a flock of 20 or 30 of the latter bird feeding upon the caterpillars. He also noticed that they had a peculiar habit of picking the caterpillars from the leaves and dropping them to the ground.

ATTEMPTED INTRODUCTION OF AN INSECTIVOROUS BIRD INTO ALGERIA.

There is a common East Indian bird, *Acridotheres tristis*, called "Meina" by the natives and "Martin triste" by the French. It does not fear man and builds under the roofs of houses. On account of its

very marked insectivorous habits it was introduced toward the middle of the last century into the island of Mauritius where, protected by an efficient law, it was easily acclimated. To this bird is credited the complete cessation of the locust irruptions in Mauritius as well as the subsequent immunity enjoyed there from various other insect pests. In view of this experience, efforts have been made to introduce this useful bird into Algeria, where, in spite of all efforts the locust depredations threaten to become permanent. In the *Revue des Sciences Naturelles Appliquées* (vol. 37, No. 9, May, 1890, pp. 404-415), Mr. L. Magaud d'Aubusson gives an account of the attempts undertaken in 1867 and 1868, but more especially of a third one undertaken on a large scale by order the French secretary of agriculture. These attempts have hitherto ended in failure, the principal reason being the rigor of the Algerian winter. In spite of all possible care, only a few of the birds survived the first winter, and these died during the second winter. Moreover, during these two years, no pairing and no nest building took place among the birds. Mr. d'Aubusson strongly advocates a continuation of these efforts to acclimatize the Meina, or to substitute for it another insectivorous bird, the *Pastor roseus*, which is widely distributed in Central Asia and Southeastern Europe. We hope that these efforts will ultimately be crowned with success, for it is possible that in their success there may be some practical outcome for our country, where, also, the severity of the winter would prevent the simple introduction and acclimatization of this semi-tropical bird.

NOTES ON MISCELLANEOUS FRUIT INSECTS.

The following insects have been observed depredating upon the Strawberry, they not having been previously recorded, so far as known to the writer, as affecting this plant.

Anomala binotata: Observed feeding on the blossoms in May. *Pyrophilapyramidoides*: Larvæ observed feeding on the underside of leaves, May 13. These larvæ were quite young, but were fed in confinement on strawberry leaves, until nearly full grown. *Arctia isabella*: Caterpillars observed during September, in considerable numbers, feeding on the foliage.

Emphytus maculatus: The females were observed at La Fayette, ovipositing in plants, April 18, and in the same place where this occurred, larvæ were found on May 20. At La Porte, Indiana, about 70 miles north of La Fayette, larvæ were found in the garden of Hon. E. H. Scott, in great abundance on July 4.

Hyphantria textor: Larvæ found feeding on the fruit of raspberries at Franklin, Indiana, on June 25. *Eupithecia miserulata*: Larvæ eating into the fruit of raspberry were repeatedly observed at La Fayette during June, some times in considerable numbers. *Ecanthus niveus*: In March a quantity of raspberry canes, containing great numbers of eggs of this species, were collected and placed in breeding cage. Late in May, a

very limited number of parasites belonging to the genus *Idris* were reared from these eggs. The young *Æcanthus* were found to be exceedingly fond of *Toxoptera*. *Eudryas unio*: Dr. Fitch, in his third report, gave the larvæ of this species as injurious to the foliage of the Grape, at the same time calling attention to the close resemblance between them and the larvæ of *E. grata*. From the fact that Dr. Lintner found that the larvæ of *E. unio* fed upon *Euphorbia coloratum*, Mr. Saunders, in his *Insects Injurious to Fruits*, first edition, page 261, considers it doubtful if *E. unio* was really a grape insect. During June we received from Knox County, Indiana, specimens of the larvæ of *unio* which were at that time destroying the foliage of grapes, thus leaving no doubt as to the correctness of Dr. Fitch's statement.—F. M. WEBSTER, October 25, 1890.

THE CODLING MOTH AS A FRIEND.

It is very interesting to see what different views people take of the same thing, according to the effect it has upon their own individual interests. Most persons would have thought that the Codling Moth was to have been universally condemned as an unmitigated nuisance, but this does not appear to be the case. One evening when a certain gentleman attended a fruit-growers' meeting at the Thames, in the Auckland Province, for the purpose of giving a lecture on the Codling Moth, he observed one man amongst the audience, who, after the lecture was over and a general meeting was being held, was particularly eloquent in denouncing the little insect. He was a fruit grower and fruit-seller, having a very good orchard, and a thriving retail business in fruit. Next day when passing the shop the lecturer was called in and had a look at the apples, which appeared unusually fine and all perfectly free from the moth. He remarked that the fruiterer need not have been so bitter against a pest that certainly did not seem, judging from the condition of the fruit, to be very troublesome in his orchard. The retailer said he would explain it by-and-by, but they would have a glass of cider first. The bottle was produced, "no sooner said than done," but before drinking a toast was proposed that astonished the visitor. "Here's to the codling moth. Long may it live, and may its shadow never grow less!" "How do you like the cider, is the flavor good?" "Yes, it is splendid; the flavor is excellent." And now came the explanation. This man was an old, experienced American fruit-grower, and he kept his orchard well sprayed with Paris green and in consequence of that and other precautions lost but very few of his apples even cheaply, and his customers preferred giving him good prices to buying other people's wormy fruit at lower rate. "Then why waste them in making cider?" "Oh, that is the best of it. I buy their apples and make the cider from them. Have another glass?" "No, thank you; not now I know what is in it." "In America," said the fruit merchant, "we set about curing an evil, but here they go to meetings to talk about it and abuse the Government. What you advised them to

do was right enough, but it was only waste of time. In this country they have their 'British growl,' as they call it, but they don't roll up their sleeves and go at it the way we do in America, and it will be a long time before any governments do anything to help them to mind what it is fairly their own business to attend to. But it is all the better for the few that do."—ORCHARDIST in the *New Zealand Farmer*.

A WINTER WASH FOR SCALE INSECTS.

We learn from the *Pacific Rural Press* of December 13, 1890, that the horticultural commissioners of Sutter County, California, are recommending the following formula for use during the winter months on all deciduous trees infested with the San José scale. It is said that the formula has been used with great success throughout the State:

40 pounds unslacked lime.
20 pounds sulphur.
15 pounds common stock salt.
Water to make 60 gallons.

Boil 10 pounds of lime and the 20 pounds of sulphur in 20 gallons of water for half an hour or more, or until both lime and sulphur are dissolved. The sulphur must be thoroughly dissolved and mixed with the lime; the mixture will then be of an amber color. Then slack in an empty half barrel 40 pounds of lime, with soft hot water, using enough water to thoroughly slacken the lime and keep it in liquid form. After the lime is slacked, add 15 pounds of common stock salt, while the material is still hot.

When the salt is well dissolved, mix the two lots together with sufficient water to make 60 gallons of spraying material, which will then be a thin whitewash. The material should be strained, after being thoroughly mixed, through a fine wire strainer.

Apply the wash milk-warm or warmer, with a spray pump.

Use either a New Bean nozzle or a San José nozzle. If the latter is used the usual brass disk accompanying it should be replaced with a rubber disk to prevent the material clogging the nozzle. Use only when foliage is off the tree.

With the exception of the salt this formula corresponds very well with the "Eureka Insecticide" manufactured by Mr. E. Bean, Jacksonville, Florida, which is of considerable use against the rust-mite on the orange and the six-spotted mite. It is by no means efficacious in the same degree against scale insects.

LADY BIRDS VERSUS SCALE-INSECTS.

Mr. Dudley W. Adams, in the *Florida Farmer and Fruit Grower* for October 9, 1890, gives a very interesting and charmingly written account of his experience in orange raising at Tangerine, Orange County, Florida, showing that a native Lady Bird, the species of which is not mentioned, completely cleared his trees from scales as soon as he had stopped applying washes. Mr. Adams was extremely fortunate, and his experience was exceptional. In general, the advice given by Mr. S. Sanders Neck, in the issue of the same journal for September 11, should be followed in Florida. He says concerning kerosene emulsions:

If they kill the lady bugs, never mind; it is a poorly managed grove that depends on these insects to destroy scale. Nothing short of kerosene emulsion is effective.

THE TARNISHED PLANT BUG DAMAGING CELERY.

We have not before called attention to the fact that, according to the *American Garden* for June, 1890, this well-known polyphagous insect has varied its diet of late by putting celery on its bill of fare. An extensive gardener and fruit grower in Kansas writes to the editor that unless he can find some effective remedy, he will have to give up growing celery. The bugs appear on the plants by the thousands, and ruin the leaves by sucking the sap. Pyrethrum and kerosene emulsion are recommended.

THE DOWNY WOODPECKER FEEDING ON THE LARVÆ OF THE CODLING MOTH.

That these birds feed upon the larvæ of the Codling Moth has been known for many years, Trimble* having shot individuals with such larvæ in their stomachs. The method of feeding has, I believe, never been described in print. At a farmers' institute, held at Auburn, Ind., Mrs. S. H. Hine, an elderly lady residing at Sedan, Ind., presented a very interesting paper on the habits of woodpeckers. In this paper Mrs. Hine, who is a most careful observer of birds, stated that she had seen this species feeding on these larvæ, extracting them from, the apple while the latter was hanging to the tree. In a conversation with this lady, following the presentation of her paper, she stated that she had observed a downy woodpecker busying itself about young apples, on a tree in her yard, and that she had watched it carefully until it worked upon an apple within her reach, and, keeping her eye on this identical apple, she approached the tree and picked it. She found that the young larvæ had evidently made some progress into the fruit, starting from the calyx, but that it had as clearly been deftly extracted by the woodpecker, and without any injury to the fruit. She had also observed the birds searching the underside of the leaves of apple trees, and apparently seeking for something concealed there, and which she thought might be the adult moths.

In a conversation with Judge McBride, of Elkhart, Ind., who is also a careful observer of birds and their ways, he stated that he had also observed downy woodpeckers extracting the worms from young apples, and he had never observed that, in so doing, the birds in any way injured the fruit. It seems, then, that the labors of this bird act not only as a preventive, but also afford actual and immediate relief to the infested fruit.—F. M. WEBSTER, *December 8, 1890.*

OVIPOSITION IN ADOXUS VITIS.

This is a rather small, blackish or brownish leaf-beetle which occurs in Europe as well as in northern North America. In Europe it is injurious to the Grape, the larva feeding on the roots and the beetle

* A treatise on the insect enemies of fruit and fruit trees, by Isaac P. Trimble, p. 113, Pl. 10, 1865.

destroying the leaves, whereas in America it is only known to attack a wild plant (? *Epilobium*). Since it is in Europe and especially in France a very serious pest of the grapevine, even more injurious than the Grapevine Flea Beetle is with us, its natural history has often been treated, especially by the French entomologists, Lichtenstein, Valery-Mayet, Girard, and others. The mode of oviposition, however, has been in some dispute, some authors asserting that the eggs are laid under the old bark near the ground, others that they are deposited on the leaves. Mr. E. Dupont has recently investigated the subject and finds (*Progrès Agricole et Viticole*, vol. x, No. 37, Sept. 15, 1889, pp. 576-578) that oviposition takes place only on the foliage, the young larvæ afterwards entering the ground. The life history of the *Adoxus* is thus in conformity with that of an allied species, *Chrysochus auratus* which lives with us on *Apocynum androsaemifolium*. We have found the eggs on the leaves and the larvæ underground feeding on the roots. The nearest North American allies of *Adoxus*, viz, the species of *Fidia*, also infest the grapevine, but their life histories have never been investigated.

A CATERPILLAR DESCRIBED AS A COCCID.

Mr. E. E. Greene furnishes the following information (*Ann. and Mag. of Natural History* for December, 1890, p. 503): From an examination of type specimens in the British Museum it was found that the *Aspidiotus bicarinatus* described by the late F. Walker (Catalogue of Homoptera, etc., Supplement, p. 306) is in reality the dried-up larva of a Limacodid moth allied to the Indian *Narosa conspersa*. This caterpillar with its coriaceous integument and two well-marked dorsal ridges has a superficial resemblance to a Coccid, but, as Mr. Greene remarks, it is difficult to understand how Walker could have made such a mistake.

INJURY OF THE HOP CROP ON THE PACIFIC SLOPE IN 1890 BY THE HOP LOUSE.

Mr. Aurelius Todd furnishes in *Entomological News* for February, 1891 (vol. II, No. 2, p. 34), some interesting statistics on the hop crop on the Pacific slope in 1890, and the amount of damage done that year by *Phorodon humuli*. The hop crop for 1890 in the State of Washington was estimated at 38,000 bales, that of Oregon at 20,000 bales; total, 58,000 bales. Estimating 200 pounds to each bale, and each pound worth 30 cents, we have a total value of \$3,480,000. Mr. Todd estimates that the loss from the hop louse amounted to at least one-fourth of what was gathered, or one-fifth of the entire crop, or to at least \$870,000 in a single year. The depredations were not evenly distributed over the entire hop-growing area. The places "exposed to the morning sun and sheltered from the wind by woods, etc., suffered most, the upper river bottoms in general next, while some places were entirely free from them."

THE HOP LOUSE IN OREGON.

Mr. F. L. Washburn, the entomologist of the Oregon Experiment Station, has just issued a circular asking for information regarding this insect. He asks of the growers whether there are cultivated plums or prunes or any wild plums or plum seedlings near their hops, and also requests information as to the exact distance of such plants from the hop fields. He prefaces his questions by the following remarks:

Since the presence of the Hop Louse (*Phorodon humuli*) in Oregon has been reported, careful examinations of affected yards have been made and the results apparently corroborate the results of observations made in Europe and America contemporaneously by the Department at Washington. These results are summarized in the statement that "the eggs of the Hop Louse are laid in the autumn on plums and prunes, more particularly the former."

This is now borne out by personal observations in this State, thousands of eggs having been found on seedling thickets of plums near an infested hop yard, while cultivated prunes in the vicinity were not affected.

It is for the purpose of gathering statistics upon this matter, *i. e.*, the varieties of plums preferred, and situation of plums with regard to hop yards that this circular is issued, in order to record such facts in bulletin report, to be shortly issued, treating of remedies, etc.

It is hoped and expected that every progressive hop-grower will interest himself in answering the following questions. *The greatest accuracy in the replies is necessary.*

COLLECTIONS OF COLEOPTERA—A RECENT IMPORTANT SALE.

We are indebted to a well-known English entomologist, and valued correspondent, for the following information, which will be of great interest to all of our readers who are students of the Coleoptera:

An important collection of one of the chief families of insects has recently changed owners, Dr. Sharp, of Dartford, England, having ceded his collection of Lamellicorns to his friend M. René Oberthur, of Rennes, France. The collection of beetles, now in the possession of Mr. Oberthur, is richer than any other, and resulting as it does from the amalgamation of several important collections, contains so many types and authenticated specimens that we have no doubt the following particulars as to some parts of it will be found of interest to savants as well as to those who are not aware of the great numbers of species of insects that have been already described, and which it is necessary to accumulate as the foundation of a general collection of insects of the world.

For many years the collection of the late Count Mnizech, of Paris, was the most renowned private accumulation of Coleoptera in the world. This collection shortly before the death of the Count passed into the possession of Meinheer von Lansberge, governor-general of the Dutch East Indies, who added very largely to it by purchases and by collections formed under his supervision in the East Indies and has now recently parted with it to M. Oberthur.

The latter gentleman was also fortunate in obtaining the collection of Carabidæ of the late Baron Chaudoir, containing the greater part of the types resulting from a lifetime of work in descriptive entomology.

Still more lately the magnificent collection of Coleoptera of Mr. James Thomson found its way to swell the ranks at Rennes. Some minor portions of this collection had however been previously disposed of to other museums, but nearly all the more important parts—especially the Cetoniidæ, Buprestidæ, and Longicornia—have gone to M. Oberthur.

Quite recently M. Raffray, of Singapore, has ceded his collection of Paussidæ to the same gentleman, who now possesses the richest collection in the world in this small but recherché group; it comprises 110 species. Confining our attention to a few of the more important divisions of Coleoptera we may say that the collection formed in the way we have mentioned contains about 11,000 species of Carabidæ, about 13,000 species of Lamellicorns, more than 4,000 of Buprestidæ and about 10,000 of Longicorns.

The department in which the collection is most advanced is probably that of the Lamellicorns. It is made up of the collections of Mnizech, Castelnau, Harold, Lansberge, Thomson, and Sharp, to say nothing of others of smaller extent, such as those of Semper and Thorey. Sharp's collection included the greater part of Baron Dejean's original collection, which in the earlier years of descriptive entomology was looked on as *the* collection of Coleoptera and was contributed to by naturalists in various parts of the world. It contained, for example, many specimens sent from North America to Dejean by the first Le Conte. By the addition of the numerous types of more recent writers contained in the collections of Harold, Lansberge, and Thomson, the Oberthur Lamellicorns are thoroughly representative of the results of descriptive entomologists in this family; indeed, in all probability this part of the collection approaches nearer to perfection than does any other existing collection of an extensive group of insects. The number of species may be said to be certainly 12,000, and more probably is nearer 13,000; the subfamily Cetoniidæ comprising upwards of 1,600 species, represented by fully 16,000 specimens.

DISEASES OF CHRYSANTHEMUMS CAUSED BY INSECTS.

Mr. J. G. Jack, in the September 10, 1890, number of *Garden and Forest*, discusses *Cicadula quadrilineata*, *Lygus lineolaris*, *Lygaeus lineatus*, *Triphleps insidiosus*, *Plagiognathus obscurus*, *Phytomyza chrysanthemi*, and *Eristalis tenax* and their damage to cultivated chrysanthemums. The Plant bugs and Leaf-hoppers, he thinks, are responsible for the trouble known to gardeners as "blinding" or "disbudding." The *Phytomyza* is the common Dipterous Leaf-miner of the Chrysanthemum, while *Eristalis* is discussed simply in connection with its supposed influence in the pollenization of these plants.

INSECT WAX.

Mr. J. R. Jackson, of the Kew Gardens, has recently published an article on the subject of "African Insect Wax," which we have seen reprinted in the *Scientific American Supplement* for June 21, 1890. Mr. Jackson calls attention to the fact that insect wax exists in large quantities in South Africa and is used among the natives as a cement for calabashes and among the Zulu warriors for head rings. It is stated that any quantity of the wax is procurable in Natal, and that it would be quite worth the while of some manufacturer to test it. The insect which causes this wax is not known, but it is doubtless a Coccid. Mr. Jackson suggests that *Icerya* might be utilized in the manufacture of commercial wax, and this suggestion may possibly be worth something to the people at Cape Colony. Just at present this erstwhile dreaded pest is practically not existant in California, New Zealand, or Australia. The egg-sac of *Icerya*, moreover, is so full of eggs that it is doubtful whether it could be practically used. Some years ago we were able to secure a large quantity of insect wax from *Lachnus longistigma* by scraping the insects from the trees into a sieve and shaking it until the wax had all passed through. We obtained nearly 2 pounds with very little trouble and handed it to the Chemist of the Department for examination. The wax was lost, however, through some accident before it could be tested, and we have never had the opportunity since to collect it on so large a scale. Some of these Plant-lice, however, where they occur in numbers, can be utilized and a purer quality of wax can be obtained from them more easily than from any of the Coccids for the reason that the bodies and eggs of the latter can not be got rid of with the same ease.

COCCINELLA NOVA-ZEALANDICA A SYNONYM.

In Bulletin No. 21 of the Division we have figured this well known New Zealand Lady-bird, and Mr. Koebele states upon page 24 that he found it at Napier feeding upon the Cabbage Aphis in large numbers. Fifty-one specimens were collected and placed in empty pill boxes, and upon arrival in California 21 were still alive and were liberated. Apropos of this figure, Dr. Sharp has written us, under date of December 24, 1890, to the effect that it has enabled him to decide what he had previously suspected from a perusal of Mr. Colenso's original description of the species, namely, that it is identical with the common European *Coccinella undecimpunctata*.

AUSTRALIAN FRUIT-GROWERS AND VINE-GROWERS IN CONVENTION.

The fruit-growers and vine-growers of New South Wales held a largely attended and apparently enthusiastic conference at Sydney last June, the full report of which has just reached us in the shape of a pamphlet of some 250 pages, published as Bulletin No. 1 of the department of

agriculture of New South Wales. Much was naturally said on the subject of insect pests, the now cosmopolitan Grape Phylloxera, Codling Moth, and Woolly Root Louse of the Apple leading the list in the importance of their consideration. Very little that is new to students of economic entomology in America was brought out, and much of the information of the best informed persons present seems to have been derived from American sources. Many practical men were there and spoke, but, as is so often the case, the difficulty of determining exactly what insect they were discussing rendered their remarks of comparatively slight value, especially at this distance. The so-called fly-bug received some attention, but this important insect is not yet scientifically determined. Mr. A. Sidney Oliff read a general paper on the subject of Insect Pests and Australian Agriculture and a series of interesting experiments by Mr. P. J. Feidler with creosote against the Phylloxera was reported. This substance is used in a pure state by placing tubular poles between the vines and pouring down the liquid. It can be mixed with water in the proportion of one part of creosote to from five to twenty-five or more of water and applied by means of a sprinkler. Mr. J. Patterson recommended the use of starch in the proportion of 2 pounds to 16 gallons of water for Red Scale. He stated that this mixture will adhere to the foliage and fruit and smother the scale, coming off in flakes after a few days bringing the scales with it and leaving the leaves and fruit as bright and clean as if they had never been infested with scale insects.

Mr. A. G. Hamilton gave a long list of Australian birds which are exclusively insectivorous and another list of those which feed partly on small vertebrates but to a large extent on insects, and another shorter list of those which eat fruit as well as insects and are more or less harmful. A list of birds living on grain and fruit is summoned up in the one word "Parrots."

The horticulturists of Victoria have not been behind their confreres in New South Wales and Bulletin No. 10 of the department of agriculture of Victoria, for September 1890 gives an account of a conference respecting a means for suppression of insect pests injurious to vegetation held August 6, 1890. The discussion of a bill submitted to the legislative council to prevent the introduction and to provide for the destruction of certain insects which injuriously affect vegetation, and for other purposes was the principal order of business. The insects specifically mentioned in the interpretation of the bill are the Codling Moth, the Round Orange Scale (*Aspidiotus aurantii*), the Hessian Fly, the Migrating Locust (designated as *Edipoda musica*) and the Colorado Potato Beetle.

A NEW PHYLLOXERA STATION IN BRAZIL.

Dr. John C. Branner, State Geologist of Arkansas, has kindly sent us a note to the effect that his copy of the *Revista de Engenharia* (Rio de Janeiro, Brazil), received November 14, 1890, states that it has been

ordered that 4,000 milreis (about \$2,000) be advanced to José Watzl to defray expenses of organizing the Phylloxera Station which the secretary of agriculture has ordered established at Fazenda Grande. The amount is small, but it is a beginning in the right direction, and is the first step which the Brazilian Government has taken regarding the investigation of injurious insects since many years.

WINTER PROTECTION FOR THE VEDALIA.

The last report of the California State Board of Horticulture contains an illustration of two glass houses erected by the board for the purpose of insuring the hibernation of the *Vedalia* in numbers, as during the winter of 1889-'90, the wet weather almost exterminated them. The houses are 16 feet in diameter by 18 feet high. Every part is carefully fitted and ventilation is secured by wire netting. They are octagonal in shape and so designed that they present as much surface to the sun as possible. They are placed at San Gabriel in the orchard of Col. J. R. Dobbin.

OBITUARY.

It is with a sense of personal loss that we record the death of Frazer S. Crawford, of Adelaide, South Australia. He has been a constant correspondent since 1885 and showed deep interest in agricultural matters and particularly in applied entomology and mycology. He was connected with the surveyor-general's office in Adelaide as a lithographer and had a considerable aptitude for illustrating insects. He had etched a number of plates (principally scale insects) and distributed them among his correspondents. Although more or less of an invalid for a number of years past his energy was surprising and his name has become known through his correspondence and his published papers in many parts of the world. For a few years past he conducted a department of the *Garden and Field*, a sound agricultural journal published in Adelaide, and his views were always read from month to month with great interest. Americans have good reason to cherish memory of him for the part he took in the introduction of the Australian enemies of *Icerya*, the results of which have proved such a boon to California fruit-growers. It was chiefly through correspondence with him that we became convinced of the advisability of the mission, and both of our agents, Mr. Koebele and Mr. Webster, on the occasion of their visit to Australia, were received by him with the utmost kindness and hospitality, and he seriously inconvenienced himself to make their mission a success. Mr. Crawford showed in his writings that large experience and those qualities of care and caution which are essential in scientific work. His death is a distinct loss to Australian applied science.

IMPORTED PARASITES OF THE HESSIAN FLY.

We have just received from Mr. Fred. Enoch, of London, a supply of Hessian Fly puparia parasitized by *Semiotellus*. We hope to acclimatize this parasite in this country, and in order to do so successfully

would like to hear from any of the station entomologists who are advantageously situated and who would be willing to take charge of a few of these puparia, with the idea of liberating the adults in wheat fields which are badly infested with the Hessian Fly.

THE AUSTRALIAN "FLY-BUG."

On page 381 of Volume II, and page 30 of the current volume we have mentioned the damage done by an insect which is popularly known by the name of "fly-bug," in different parts of Australia. This insect seems to have made its appearance as a marked pest in 1889, although Mr. Tepper writes us that he has known it to occur in great numbers in wheat fields in Australia since 1853. In 1889 and 1890 it seriously damaged the vineyards, orchards, and gardens of New South Wales. It attacks particularly the fruit-stems of the Grape, Plum, and the Apple, causing the fruit to dry up instead of ripening. It is, in fact, practically omnivorous, causing great injury to all common fruits, cereals, and vegetables. We suspected from accounts and figures that this insect was the False Chinch-bug of this country, (*Nysius angustatus*), and wrote Mr. Fraser S. Crawford last fall to the following effect:

I am particularly interested in the insect which you call the "fly-bug," and which Mr. Tepper places in the genus *Pachymerus*. Your figure very much resembles our American *Nysius angustatus*, and on the supposition that it is this insect accidentally imported into your country from the United States, I am desirous of seeing specimens. Can you not send me some? I did not receive it from Koebele.

Mr. Crawford's sending as well as a subsequent one from Mr. Tepper were, unfortunately, lost in the mail. In the letter accompanying the lost specimens Mr. Crawford wrote that the insect was considered by Mr. Tepper and himself to be one of the *Lygaeidae*, but that Mr. Skuse thought it a Capsid. Mr. Skuse, in fact, determined it, as we have shown upon page 30 of the present volume, as a species of *Phytocoris*. Later Mr. Crawford sent two specimens from which we are able to determine unhesitatingly that our surmise is correct as to the genus and that the insect is very close indeed to our *Nysius angustatus*, which feeds on a variety of plants in this country, (principally on *Cruciferae*) and has been reported from California on Grape.

In the meantime, in the March number of the *Entomologists' Monthly Magazine*, Dr. E. Bergroth has an interesting article referring to the accounts of this insect's injuries in Australia and describing it as *Nysius vinitor*, n. sp. He does this after having, as he states, compared it with the descriptions of all hitherto described species of *Nysius*. A careful comparison of the two rather poor specimens from Australia with American specimens, in the light of Bergroth's description, would indicate that *vinitor* differs from *angustatus* in being somewhat narrower, in the absence of pubescence above, the more slender and longer basal joint of hind tarsi, and the shorter, more bulbous basal joint of antennæ. It is also a darker species. But what we stated in our description (as

destructor) of *angustatus*, (Fifth Report Insects of Missouri, p. 113,) viz, that "the species is so variable that it is difficult to see wherein some of the specimens differ from the European *thymi* or from *angustatus* Uhler" will probably hold true.

THE ENTOMOLOGICAL SOCIETY OF WASHINGTON.

December 4, 1890.—The corresponding secretary read a paper by Mr. P. R. Uhler, entitled "Observations on some remarkable forms of Capsidæ," in which were described two new genera, *Heidemannia* and *Peritropius*, represented by one species each, viz, *H. cixiiformis* and *P. saldaformis*. The paper also contained a note on the recent discovery by Mr. Heidemann in the District of one of Say's long-lost species, *Cylapus tenuicornis*.

Mr. Howard read a paper on the "Parasites of the Hemerobiinæ," in which he spoke of the known Hymenopterous parasites and added the Encyrtid genus *Isodromus* as the only known primary parasite in the country, with the single exception of the egg-parasite mentioned by him on page 10, vol. 1 of the society's proceedings.

Mr. Marlatt presented a note, in which he proposed the specific name *unicolor* for a species of *Monoctenus*, the larva of which feeds on the red cedar. This saw-fly had been described by him as *M. juniperi* (see Trans. Kans. Acad. of Sci., vol. x, p. 82), which name was preoccupied by a European species of the genus.

Mr. Banks read a paper on *Thalamia parietalis* Hentz, a spider which he had taken in Texas and which had been lost since Hentz's time. In studying this species in connection with the Pholcidae, Scytodidae, Filistatidae, Urocteidae, Enyoidae, and Hersilidae, he reached the conclusion that these spiders are closely related and ought to be included in one group of family importance, for which he proposes Dugès' name Micrognathes changed to Micrognathidae.

Mr. Townsend read some notes on Tachinidae *sens. lat.*, synonymical and critical, with particular reference to the confusion of the sexes by early describers. A number of species were noticed and several new ones were described.

Professor Riley read and commented on letters from Mr. William H. Ashmead, now studying in Berlin, and Mr. S. S. Rathvon, of Lancaster, Pa. He then read a note on an exotic roach (*Panchlora viridis*), which he had recently received from Dr. C. F. Gissler, of Brooklyn, N. Y. The remarkable feature was that the roach was certainly viviparous, a habit believed not to have been hitherto recorded of any species of the family Blattidae. Figures of the parent roach and of its young greatly enlarged were shown. Professor Riley gave an account also of his additional study of *Platypsyllus*, in which he mentioned the discovery of a large number of insects (and some mites and myriapods) which are associated with the beaver either accidentally or as parasites or guests. He also called attention to the curious larvæ exhibited by C. J. Gahan at the October 1, 1890, meeting of the London Entomological Society. Professor Riley thought from the short description that they must belong to the *Blepharoceridae*. He also referred to the undetermined larva described by Mrs. Julia P. Ballard in the October number of *Entomological News*, p. 124, and said that it was without doubt the larva of *Citheronia sepulchralis* G. & R. He then called attention to an interesting paper read by Professor Forbes at the recent meeting of the Association of Economic Entomologists, relating to the periods of transformation and to the specific characters of *Lachnosterna* larvæ. These matters were discussed at considerable length by Professor Riley, and two new parasites of *Lachnosterna* were added to those hitherto known.

Mr. Schwarz presented a note "On the feeding habits of Empidæ," in which he described the habits in this regard of a species of the genus *Syneches*, which was very abundant in the mountains at Fort Pendleton, Maryland, during the first part of July. Their vertical position in flight and peculiar method of holding their prey

and of hanging by one fore-leg while devouring it were described. He also discussed the recent publication by Ed. Fleutiaux and A. Sallé, on the Coleoptera from the Island of Gaudeloupe, West Indies, Ann. Soc. Ent. de France, 1889 (1890). The relation of the species enumerated to the fauna of the United States was particularly dwelt upon.

January 8, 1891.—The annual meeting of the society was held at the residence of Prof. C. V. Riley, and the officers for the past year were re-elected, as follows:

President, George Marx; vice-presidents, C. V. Riley and L. O. Howard; corresponding secretary, C. H. Tyler Townsend; recording secretary, C. L. Marlatt; treasurer, B. P. Mann; executive committee, E. A. Schwarz, Otto Heidemann, W. H. Fox. The president, Dr. Marx, delivered an address on "The spiders of the District of Columbia," in which he discussed at length the value of local lists as a means of forming a comprehensive knowledge of the fauna of a country. He referred to the somewhat scanty literature in this country of this nature as compared with that of Europe, giving also a bibliography of the more important writings on Araneæ of both this country and Europe, and concluded with a list of the spiders found to occur in the District.

The address was discussed by Messrs. Riley, Fernow, Marx, Schwarz, Smith, Dodge, Banks, and others.

February 5, 1891.—Mr. Schwarz called attention to certain Micro-Lepidoptera which breed in the fruit of *Solanum carolinense*, stating that he had bred *Gelechia beneficentella* and referred to the fact that no similar insects were known to breed in the fruit of the cultivated potato.

Dr. Marx spoke of the spiders of the genus *Pholcus* of which nine species occur in this country as against one or two found in Europe. He exhibited specimens of the American species.

Mr. Schwarz exhibited specimens of *Casonia ludoviciana*, found this winter in great abundance near Washington, D. C., and remarked on the distribution and habits of this insect.

Professor Riley laid before the society an interesting card which he had recently received from Mr. McLachlan referring to the *Blepharocericid* larvæ mentioned at the previous meeting of the society. Mr. McLachlan fully confirmed Professor Riley's reference of the larvæ in question.

Mr. Townsend read a paper on a remarkable new Hippoboscid received from Dr. Alfredo Dugès, Guanajuato, Mexico, which had been taken on a bat. It was described as *Trichobius* n. gen. *dugèsi* n. sp.

Mr. Townsend also presented a paper on a Muscid, bred from swine dung, which he described in its larval and imago states as *Cleigastra suisterci* n. sp. This case of breeding had shown a larval hibernation, and Mr. Townsend expressed the belief that in more northern latitudes most Coprophagus Diptera (*Hæmatobia Lucilia*, etc.), winter equally as larvæ or pupæ, and only exceptionally as perfect flies.

These papers were discussed by Messrs. Riley, Fox, Banks, Schwarz, Marlatt, and Townsend. Mr. Schwarz presented for publication descriptions of two North American species of the Cuculionid genus *Phytobius* and one of them he considered to be identical with the European *Phytobius velatus*. The other is described under the name of *Ph. griseomicans*. Mr. Schwarz also spoke of the difficulty in recognizing from the descriptions the North American species of *Pityophthorus* and pointed out that only secondary sexual characters seemed to offer a satisfactory criterion for the separation of many closely allied species. The *Pityophthorus* so common under bark of Liquidambar is not *P. annectens*, as formerly assumed by him, but is identical with the species occurring under bark of Sumach and which is named in collections *P. consimilis*.

C. L. MARLATT,
Recording Secretary.



SPECIAL NOTES.

Economic Entomology in Canada.—The reports of the officials of the Experiment Farms of Canada for 1890, have just reached us in the form of a compact document of some 300 pages. Mr. James Fletcher, as Entomologist and Botanist, covers pages 154 to 188. The insects treated are the American Frit Fly (*Oscinis variabilis*), the Cabbage Maggot, the Cabbage Plutella, the Mediterranean Flour Moth, the Pea Weevil, the Strawberry Weevil (*Anthonomus musculus*) and the Vancouver Island Oak-looper (*Ellopiia somniaria*). All of the articles are treated from an original standpoint, and include the results of original experimental work. He shows the differences in the effects of the attack of the Frit Fly, the American Meromyza, and the Hessian Fly, differentiating carefully between the three species in all stages. A new remedy for the Cabbage Maggot has been carefully tried and might answer on a small scale. It consists in watering the cabbages with a decoction of 2 ounces of white hellebore in 3 gallons of water, a half teacupful being syringed forcibly around the roots of each plant after the surface of the soil has been removed by the hand. The liquid seems to act by contact. Kerosene emulsion is, after experiment with a number of substances, unhesitatingly recommended for the Cabbage Plutella. It is stated that Canadian seedsmen use bisulphide of carbon as a remedy for the Pea Weevil very extensively.

The statement is made that nearly every large grower has a building for the purpose, made perfectly tight with tin or cement. The building is filled with bags, and a pan 10 feet across and 4 inches deep is hung up close to the ceiling. It is then filled with the bisulphide, the doors are tightly closed, and the building left for forty-eight hours. The remedy is effectual when tried in warm weather. Exactly what Canadians understand by the expression "warm weather" is then explained by the remark: "It does not work well when colder than 10 degrees above zero!" Against the Strawberry Weevil (*Anthonomus musculus*) Mr. Fletcher suggests covering the beds, after the flower buds are formed, with old newspapers, held down at the edges with a few handfuls of earth, or with strips of cheese-cloth or muslin, to be put on at the first appearance of the beetles and kept on until the flower has

expanded. This, it seems to us, would be of little advantage in wet weather. The article on the Vancouver Island Oak-looper possesses much interest on account of its novelty. This insect defoliates the oaks in the vicinity of Victoria every 3 or 4 years. The larvæ are most abundant about the middle of August, pupate the latter part of this month, and emerge as moths from the 20th of September on into October. We quote from the account given by Mr. W. H. Danby, a correspondent of Mr. Fletcher's (page 176):

On 20th September the moths were emerging in every direction, and crawling up the trees to find a favorable spot to expand their wings. I now counted one hundred and twenty-seven, and this was the beginning of one of the most wonderful entomological sights I have ever seen. By 5th October the moths were in myriads, the trees being literally covered, not only on the trunks, but on every limb and branch as far as the eye could discern, so close together that the wings overlapped. On shaking a branch they would fly off in such numbers that you could positively hear them fly. When the moths first appeared the males averaged 90 per cent of the whole, but on 24th October the females bore the same proportion to the whole. About this time heavy fogs set in, and the ground around was strewn with dead bodies.

The insect hibernates in the egg state, and is destroyed by three parasites: *Ichneumon cestus*, *Pimpla*, n. sp., and a *Tachina*. The eggs should be sprayed in winter with kerosene emulsion, and the caterpillars may be killed by the arsenical mixtures.

We are pleased to notice that this year the report is printed on better paper than the previous reports.

The Mouth-parts of Diptera.*—In his recently published (November, 1890), paper on this subject, Professor Smith criticises the hitherto accepted homologies of the dipterous mouth-parts, and concludes that the accepted terminology of these parts should be radically modified. He has examined a large number of forms representing the main families of the Diptera, and claims that he shows that the mandible of previous authors is in reality the maxillary palpifer (or perhaps the stipes, he is not certain which); that the so-called labium is really a modification of the galea, while the so-called maxillæ are, in point of fact, the laciniaë, and the epipharynx and hypopharynx are ligula and paraglossæ. He has also indicated what he believes to be the mentum and the labial palpi, and he has found the true mandibles only in *Simulium*.

Conclusions of so radical a character should be accepted or rejected only after the most careful review of the entire ground, and cautious and critical study of the types examined by Professor Smith, as well as of forms of other groups. His work will doubtless cause a reëxamination of the whole question.

Professor Smith has put forth his paper in a sensible, straightforward way, has illustrated all of his important dissections, has deposited his slides in the National Museum, and thus invites investigation.

* A contribution toward a knowledge of the mouth-parts of the Diptera. By Prof. John B. Smith, Author's Extra from Trans. Am. Ent. Soc., XVII, 319-339.

We would call his attention to the fact that the mere showing of the original paired character of the organ previously known as the labium is by no means an argument in favor of its galear homology, as would be inferred from his statement on page 338, since the labium is in reality typically a paired organ. The author refers in the foot-note upon page 324 to our figure of the head of *Simulium* in the report for 1886 as very accurate and as showing the mandibles properly. "But," he adds, "the meaning of the structure was not recognized by either author or artist." This last is a pure assumption, and the stricture is not justified because the article accompanying the figure was purely economic and specific, and in no way raised or discussed the question of oral homologies. We might, with just as much relevance, follow a reference to his figure of *Aphidius*, on page 10 of his Bulletin No. 72, with the assertion that Professor Smith does not understand the homologies of the thoracic sclerites.

Insecticide Experiments in New Jersey.*—In this 34-page bulletin Professor Smith has recorded his experience with different insecticides during the year 1890. Such records of actual experience are always interesting and frequently of great value, even when the results are negative in their character. The author devotes some space to generalizations and accounts of the best machinery, and then considers the following insecticides: Arsenites, potash salts, tobacco, naphthaline, fish-oil soaps, kerosene emulsion, Paris green, lime, white hellebore, tar water, gas tar, carbonate of lime, Eureka insecticide, and sludge-oil soap. He recommends a combination of London purple with Bordeaux mixture where both fungicide and insecticide effects are wanted and states that the lime in the Bordeaux mixture is sufficient to neutralize any burning effect of the purple. (Compare with this Mr. Maynard's results below.) He recommends the use of potash salts, preferably kainit, against Cut-worms and Wire-worms in corn.

The tobacco experiments were effectual against Flea-beetles and Rose Aphides. The tobacco preparation known as X. O. Dust killed Leaf-beetle larvæ and Cabbage Worms. It does not affect hairy larvæ or hard-shelled insects. The addition of enough carbolic acid to moisten and discolor tobacco powders increases their efficiency 50 per cent. Under this head the entirely erroneous statement is made that X. O. Dust has been said by Mr. Howard to be a specific for the Potato Flea-beetle. Mr. Howard has never made this statement, nor has he experimented with this substance upon this insect. Fish-oil soap solutions were found very efficacious against Plant-lice whenever these could be reached. The difficulty was one of application simply. Kerosene emulsion, made according to the Hubbard formula, killed the Cottony

* Insecticides and how to apply them. Experiment Record for 1890, by John B. Smith. New Jersey Agricultural Experiment Station, Bulletin 75, November 7, 1890.

Maple-scale when diluted 12 times. It was also efficacious against the Cabbage Maggot. Eureka insecticide was found to be a specific against the Red Spider, but was unsuccessful against everything else. Sludge-oil soap, manufactured by the Columbia Chemical Works, Brooklyn, killed the Rose Chafer, the Striped Cucumber-beetle, and the Elm Leaf-beetle.

The Screw-worm again.—We have not yet noticed the bulletin from the Texas Agricultural Experiment Station upon the subject of this cattle pest, prepared by Dr. M. Francis. Dr. Francis goes carefully over the ground recently treated by Professor Morgan, of the Louisiana Station, and gives a very good summary of the habits of this insect, illustrated by very fair figures. Dr. Francis's observations lead him to believe that the egg may hatch within 24 hours after oviposition, and that the larvæ require about a week for full growth, while the pupa state occupies from 9 to 12 days. There is great confusion of generations, and while the larvæ are developing in the wounds other flies are continually laying fresh eggs in the same spot, thus keeping up a constant progressive irritation and loss of tissue. They grow in wounds from horns, castrating, spaying, branding, dehorning, barbed-wire injuries, and often where ticks have burst on the brisket or flank, and just behind the udder of cows. They often grow in the vulvæ of fresh cows, especially if there has been a retention of the placenta after birth. Young calves are almost invariably affected in the navel and often in the mouth, causing the teeth to fall out. He records an interesting case in which twenty-five full-grown larvæ were found in hair balls in the stomach. The explanation is that the calf had licked sores upon his legs containing worms. Hogs are often badly attacked, horses and mules less often, while sheep are comparatively free, except where they have been bitten by dogs. The treatment consists in killing the larvæ with cresylic ointment, calomel, chloroform, or carbolic acid. The wound is afterwards filled with oakum and the edges are annointed with tar, to prevent further oviposition.

The Sugar-Cane Borer.*—Professor Morgan has just published a short account of *Chilo saccharalis* and its damage to sugar cane and sorghum in Louisiana. He is of the opinion that the damage caused by this insect is much greater than the planters really suspect. The article contains little that is definitely original beyond the finding of the larva of one of the Soldier beetles (*Chauliognathus pennsylvanicus*) in the burrows feeding upon the borer larvæ. The bulletin ends with a series of questions to planters calculated to draw out fuller information during the coming season.

* Bulletin of the Louisiana State Experiment Station. Second series No. 9. "Sugar Cane Borer and its Parasite," by H. A. Morgan, Baton Rouge, 1891.

The fact that this insect has, since 1880, been known to seriously infect corn as well as sugar cane and the fact that recent experiments in the cultivation of sorghum in Louisiana have shown that this crop is even more badly damaged than the corn crop, renders the destruction of this insect a more complicated matter in our Southern States, perhaps, than in other cane growing countries. In our 1881 experience the proportion of borers found in the tops was comparatively small; yet we recommended the burning of these tops as a necessary step in the way of prevention. The large majority of borers we found in the portion of the cane which is crushed in the mill, so that in ordinary seasons the planters keep the insects in comparative subjection without effort. The principal place of hibernation on the plantation which we visited (Dr. Wilkinson's) was in seed cane which was laid down in "flat mat," and we have every reason to believe that if our three recommendations of selecting the seed cane from that least damaged by borers, laying it down in furrows, and burning all infested tops, are followed, the damage from this insect will be reduced to a minimum. Where much corn is grown upon the same plantation great care must be taken to burn the stalks and stubble during winter.

Paris Green in England.—The conservatism of English fruit-growers seems at last to be in a fair way to be overcome, largely through Miss Ormerod's energetic efforts. She has just put out an eight-page leaflet entitled "Paris Green (or Emerald Green): its uses and methods for its application as a means of destruction of the Orchard Moth Caterpillars." It seems that a conference of fruit-growers was held at Evesham in February, 1890, and a committee of experiment was formed of gentlemen personally interested in the subject in order to try the effect of different sprays on Orchard Caterpillars. At the several meetings of the committee held at different times during the year, the experiences related showed a great deal of uncertainty regarding the effect of all the applications tried except Paris green. Miss Ormerod has brought together from the accounts of these experiments, from the reports of this Department and of the experiment stations, and more particularly from matter communicated to her by Mr. James Fletcher, Dominion Entomologist of Canada, a very handy little summary of the best methods of application, precautions to be taken, and proportions to be used, from which it appears that the foliage in England is, on the average, comparatively nonsusceptible to the effects of the arsenic, and that the proportions which should be used are about the same as those which have been found best for Canada and our Northeastern States.

Insecticide Experiments in Massachusetts.—Mr. S. T. Maynard, Horticulturist of the Massachusetts Experiment Station, in Bulletin No. 11

(January, 1891), records some interesting experiments with fungicides and insecticides on the Apple, Pear, and Plum. Two series of experiments are of interest to entomologists, as they combine fungicides and insecticides in the same solution, namely, ammoniacal carbonate of copper with Paris green, and the Bordeaux mixture with Paris green. The first series of experiments resulted in a saving of 41 per cent of apples from Codling-Moth injuries, while the fungicide results were entirely unsatisfactory, although the application of ammoniacal carbonate of copper without the addition of Paris green is reported by other stations to have given remarkable results. With the combination of Bordeaux mixture with Paris green no favorable results were obtained, although as the applications were not begun until May 29, the failure may have been due to this fact. With regard to the fungicides, Mr. Maynard noted that the amount of scab was larger in every case where they were used than where they were not used. This result, however, he states, may have been in part due to the damage by the Paris green, which was especially noticeable where it was used at the rate of 1 pound to 200 or 300 gallons of the liquid.

Some Strawberry Pests.*—Mr. H. Garman, Entomologist and Botanist of the Kentucky Experiment Station, writes in a recent bulletin of a number of insect enemies of the Strawberry, and also of the Strawberry Leaf-blight Fungus (*Ramularia tulasnei*). The insects treated are the Strawberry-leaf roller (*Phoxopteris comptana* Frohl.) which in Kentucky is shown to have at least three annual broods—the last one wintering as larvæ; the Strawberry Crown-borer (*Tyloderma fragariæ* Riley); the Strawberry False-worm (*Emphytus maculatus* Norton); White grubs (*Lachnosterna* spp.); the June bug (*Allorhina nitida* Linn.); the Strawberry Root-worms, larvæ of the following Chrysomelids: *Paria canella* Fab., *Graphops nebulosus* Lec., and *Colaspis brunnea* Fab.; the Smeared Dagger (*Apatela oblongata* Smith and Abbott), the larva of which is reported to be a common enemy of this plant in Kentucky; and the Tarnished Plant bug (*Lygus pratensis* L.).

Efforts to stamp out the Gypsy Moth.—Economic entomologists, and for that matter the people of the country at large, are watching with much interest the efforts of the State of Massachusetts to control or stamp out the Gypsy Moth, which, since Professor Fernald's announcement of its widespread injuries, has attracted special attention. Upon urgent request, we attended a conference called for the discussion of ways and means of dealing with the subject, which was held at Boston on the 4th of March last, and we publish in this number a stenographic report of said conference. We also include an interesting article by

* Kentucky Agricultural Experiment Station, Bulletin, No. 31, December, 1890.

Prof. B. E. Fernow, Chief of the Forestry Division of this Department, which summarizes some of the more important facts connected with the management of an allied pest in the northern parts of Europe. Without going into detail, we may state that the special commission appointed by the Governor to investigate, and if possible exterminate the insect, became, as we feared it would from the manner in which it was formed, very unpopular, and its work has been very severely criticised. The present Governor has re-formed the commission, constituting it chiefly from the membership of the State Board of Agriculture, and there is reason to believe that whatever can be done by man's agency will now be done. Since the conference was held, we have learned that a great deal of good preliminary work has been done by the new commission, and that it is going on bravely. The commission have thirty spraying teams, each with a pump running two lines of hose, and gangs of carefully selected men, numbering in all 175. The eggs have been found on a wider extent of territory than had been supposed, or than had been estimated at the time of the conference, and in all cases the caterpillars seem to have been carried by teams, usually in manure, particularly from the infested territory. The commission is cutting and burning brushlands, and useless trees and has asked for further support from the legislature. The task is a formidable one, but we are still firmly of the belief that an energetic effort, at whatever cost, to stamp it out entirely, is justified. One of the difficulties which the commission seems to be meeting with, is the popular prejudice against the use of Paris green. The fruit-growers of Massachusetts are evidently not as progressive or well informed as many of their brethren in other parts of the country, or they would know that, properly applied, there is no danger whatever and that, in addition to preventing the injury from this Gypsy Moth, the treatment will also protect their orchards from other insect pests. Experiments have fully proved that, even where a large quantity of the insecticide drops upon the grass below and stock feed upon such grass, no injury is done to them. However, there is no need of such reckless use of the poison. It may be used so that it can not do any possible harm to anything and yet be thoroughly beneficial to the trees treated.

A Massachusetts Bulletin.*—Professor Fernald takes up in this bulletin a number of the commoner fruit and garden pests, giving popular summaries of life histories and remedies. The species treated are the Bud Moth (*Tmetocera ocellana*), Spittle Insects, the Squash Bug, the Pea and Bean Weevils, the May Beetle, the Plum Curculio, the Onion Maggot, the Cabbage Butterfly, the Tent Caterpillars, the Stalk Borer, the Pyramidal Grape-vine Caterpillar, the Grape Berry Moth, the Codling Moth, the Cabbage Plutella, and the Gartered Plume Moth. The

* Massachusetts Agricultural Experiment Station, Bulletin No. 12. Report on insects. Amherst, April, 1891.

numerous figures are borrowed without acknowledgment to original sources. The most original article is that upon the Bud Moth, which, it is stated, has done a vast amount of damage to fruit trees in Massachusetts by eating out the inside of both leaf and flower buds. It is a frequent cause of the failure of grafted scions. The remedy suggested is to gather all the leaves in the fall, burn them, and to spray with Paris green and water in the spring when the buds begin to swell. A full technical account is given, including the history of the literature, descriptions of the different stages, and an account of the life history. He reared the Ichneumonid *Phytodietus vulgaris* from the larva of this insect, and has proved it to be an external parasite. Under the head of Spittle Insects he gives some account of the species common upon grass in Massachusetts. The other articles are, in the main, compiled, with no reference to authorities, and need no further mention.

Miss Ormerod's Fourteenth Report.*—Miss Ormerod continues her admirable work with the publication of her fourteenth report which sustains the reputation which these reports have already gained for care, accuracy, and practicalness, combined with a most agreeable and lucid style of presentation. The principal subjects treated this year are the so-called American Blight, the Apple Chermes, the Stem Eelworm and its damage to beans and clover, the American Clover-seed Midge, which, as we have already stated in *INSECT LIFE*, has made its appearance in England, the Hessian Fly damage during 1890, the Mediterranean Flour Moth and its recent work in England, the Orchard Moth Caterpillars, including an extended consideration of Paris green and London purple as remedies, and the Horse Bot Fly. Several other subjects are treated in more or less detail. The report contains nearly 150 pages and is, as usual, fully illustrated.

Economic Entomology in Indiana.†—Under the caption "Entomological Notes," Mr. F. M. Webster publishes a number of articles in a late bulletin of the Indiana Experiment Station, some of which are reprints of articles previously published in *INSECT LIFE*. The latter are "Experiments with the Plum Curculio" (*INSECT LIFE*, II, pp. 305-310), and "Some hitherto unrecorded Enemies of Raspberries and Blackberries" (*INSECT LIFE*, II, p. 257). In addition to these are short articles on the Strawberry Crown borer (*Tylocoderma fragariae*, Riley), the common Field Cricket as an enemy of the fruit of the Strawberry, and *Haltica ignita*, Illig, which has recently become known as a strawberry pest. (See *INSECT LIFE*, II, p. 369.)

* Report of Observations of Injurious Insects and Common Farm Pests during the year 1890, with Methods of Prevention and Remedy, by Eleanor A. Ormerod. London. Simpkin, Marshall, Hamilton, Kent & Co., limited. 1891.

† Purdue University Agricultural Experiment Station, Bull. 33, vol. ii, October, 1890.

The Glassy-winged Soldier-bug.*—Under this title Prof. H. E. Summers has published a short account of *Hyaliodes vitripennis* Say, a little Capsid which preys in Tennessee upon the Grape Leaf-hopper and becomes an important factor in the destruction of this well known pest. In our Third Report on the Insects of Missouri we have given a similar account of the work of this insect in Missouri.

Importation of Hessian Fly Parasites.—We have received an additional lot of Hessian Fly puparia infested with the European parasite *Semiotellus nigripes*, from Mr. Fred. Enock, of London. The parasites began issuing the last week in April, and we have divided them into three lots and sent them to Mr. F. M. Webster, at La Fayette, Indiana, Prof. A. J. Cook, at Agricultural College, Michigan, and Prof. S. A. Forbes, at Champaign, Illinois, deeming this course the best, not only on account of the advantageous localities, but on account of the excellent care which the specimens will be sure to receive at the hands of these gentlemen.

Recent Publications of the Division of Entomology.—During the last two months several publications of greater or less value have been issued by this Division. March 12 the Fifth Report of the U. S. Entomological Commission made its appearance. This is the final report of the Commission and is a revised and enlarged edition of Bulletin No. 7. Like the latter publication it was prepared by Dr. A. S. Packard, and includes a consideration of the insects affecting forest and shade trees. It is a large volume of 963 pages and is illustrated by 306 text figures and 40 plates.

Bulletin No. 7 of the Division on the Pediculi and Mallophaga affecting man and the lower animals, by Prof. Herbert Osborn was issued April 1. No. 7 of the series of Divisional Bulletins has been held open for some time for a monograph of the genus *Acronycta*, the manuscript and figures for which have been for the most part in hand for several years. Continued postponement, however, has been caused by press of other work and it has been deemed best to fill up the series by substituting the present bulletin. This consideration of the Pediculi and Mallophaga was written to form part of a report upon the insects affecting vertebrate animals by Dr. Riley and Professor Osborn. Various causes having delayed the publication of the report, it was deemed advisable to publish this chapter in advance.

Bulletin No. 24 of the Division on the Boll Worm of Cotton, a report of progress in the investigation of this insect, by Mr. F. W. Mally, was issued from the press May 11. This is simply a preliminary report and we hope to follow it at the close of the supplementary investigation of this insect with a fuller consideration of the subject than has yet appeared.

* Bull. Agric. Exper. Station, Tenn., iv., 1, pp. 32, 33.

Circular No. 1, New Series, was also published May 11. It includes certain condensed information concerning the more important insecticides and is for use in correspondence chiefly. It is the first of a series of this character which we hope to publish in order to meet those questions which experience has shown us to be most often asked by the correspondents of the Division.

Before this number of *INSECT LIFE* appears Bulletins 23 and 25 of the regular series will undoubtedly have been published. Bulletin No. 23 includes the reports of the field work of the agents of the Division during the year 1890. It is prepared on the same plan as Bulletin No. 22 of this series. Bulletin No. 25 takes up the subject of destructive locusts and is a popular consideration of a few of the most injurious locusts of the United States together with the best means of destroying them. It is an emergency Bulletin published chiefly for distribution at present in those portions of Idaho, Utah, and Montana which were overrun last season by non-migratory locusts, but it will also meet the demand for practical information, whenever local or migratory species may appear in destructive numbers. Its publication was necessitated by the fact that the First Report of the U. S. Entomological Commission and the Annual Report of this Department for 1877 are out of print.

Recent changes in the force of the Division.—We announced on page 310 that Mr. C. H. Tyler Townsend had resigned his position in the Division to accept the post of Entomologist to the State Experiment Station of New Mexico. By a competitive civil service examination, held during May, his place has been filled by Mr. F. H. Chittenden, of New York, formerly editor of *Entomologica Americana*, and curator and corresponding secretary of the Brooklyn Entomological Society. Mr. A. B. Cordley, formerly Entomologist of the Agricultural Experiment Station of Vermont, has also been appointed to a position in this Division.

REPORT OF A DISCUSSION ON THE GYPSY MOTH.

[At a Conference held in the rooms of the Committee on Agriculture, Boston, Mass., March 4, 1891.]

Present, Prof. N. S. Shaler, Mr. F. H. Appleton, and Mr. Wm. R. Sessions, of the State Board of Agriculture, Profs. C. V. Riley and C. H. Fernald, Mayor Craig of Medford, Mayor Gould of Melrose, Mayor Pierce of Arlington, and Mayor Wiggins of Malden, and others. Mr. S. H. Scudder came in later.

Professor SHALER. You know that about 20 years ago an interesting Frenchman brought an interesting bug to this country. His name was Trouvelot, and he brought the creature thinking to introduce it as a valuable silkworm. I begged him to destroy his specimens, and at one time he said he had. It appears, however, that they got away from him. Last year I went before the legislature and begged for some money, advising them to put \$100,000 at the disposition of a trustworthy commission. They appropriated \$50,000 and appointed a commission which did a good deal of work and expended a good deal of money and energy. I begged them to bend their energies to

bringing in the boundaries as far as possible, to pay the market price for eggs and grubs, and to put their inspection work in progress, but they went into a miscellaneous sprinkling and burning over the whole territory. The result now is that, as nearly as I can ascertain, it would take a line 30 miles long to inclose the area these insects occupy. They are found in a territory of not far from 50 square miles, though not all over it. I should think that not more than 10 square miles were solidly occupied. On the rest of it there are colonies here and there.

The situation seems to me discouraging in a certain way, but it is an encouraging fact that in about 20 years they have not occupied more than about 50 square miles, and it shows that they are not to be readily transported to a great distance. Another encouraging fact is that as far as I can learn, save at two or three very limited points south of Charles River, the creature may be inclosed in this line on this side the river [a map was shown], which it does not seem to have passed easily. It passed those few points probably in hauling manure.

Professor FERNALD. Are you quite sure of the boundaries? They are reported in Maine and western Massachusetts.

Professor SHALER. I know they are, but putting the worst face upon it, as I am at present doing, I think an area of something like 5 by 10 miles is the region that has got to be closely studied. There is a reasonable suspicion of it over an area of, say, 50 square miles, and the work has got to be done over that area. One of the discouraging features is that there is a great traffic through this territory. Railroads and wagon roads go through it, and there is a pretty large traffic in manure out of the district. We have \$24,000 to spend, for certain, and I am sure the legislature will give us anything in reason we ask for.

Mr. APPLETON. It seems to me the situation is this: Can we eradicate this thing; and, if so, how? If we can not eradicate it entirely, what is the best we can do? Now, the first question to consider, it seems to me, is, can we eradicate it or not?

Professor SHALER. We should like to have the opinion of experts on that point. Professor Riley, will you give us your word?

Professor RILEY. I will be very glad to give you whatever suggestions I can on the subject. I have taken the same interest in this matter since it was so prominently announced that I do in all matters of applied entomology, and I have felt that in the main, Professor Fernald's original suggestions were very wise. The insect, as Professor Shaler has well said, has but limited powers of spreading. While the female has wings, it is heavy-bodied and flies but little, and the history of the past 20 years shows that its spread has been very gradual. Therefore we have a condition of affairs totally different from that prevailing in the insect's native home, Europe, and we are justified in making a strong effort to undo the harm that has been done. That brings up, first of all, the question, is it practicable to exterminate it or not? In view of Professor Shaler's statements, I have serious doubts; because if it may be said to occur in an area of, say, 50 square miles, if it is found even in a number of central points of distribution in that area, there is great danger, in my judgment. My own fears would be that it has got into the woods and onto trees that are not so easily treated. So long as it was confined to cultivated trees and plants under cultivation I think there would have been no difficulty at all, and the authorities would have been blameworthy in allowing it to go out from Massachusetts over the rest of the country.

Professor SHALER. I don't think it has gotten into the woods. I think it is still confined to the artificial grounds as yet.

Mr. APPLETON. Don't you think it would be a good plan to ask these gentlemen representing the different towns what their experience is in that direction?

Mr. CRAIG thought in a general way that they did not attack forest trees; were confined as a rule to orchard trees and trees surrounding houses. Thought the reason the spread was not greater the last 20 years was because the people took the insect for some kind of canker worm and took pains to burn them off the trees, which they did until they became too numerous to control. He recommended the use of tarred

paper tied round the trees with a string. Undoubtedly the commissioners had destroyed a great many of the insects.

Professor RILEY. It is well known to feed upon a number of different forest trees that grow with us, and in the event of its getting beyond cultivated plants I should, as I said, have very little hope of its ultimate extermination. I am not an alarmist, and I do not believe that our people need to be so very seriously affected if it is not exterminated, but, aside from that, the loss would go on increasing annually, and it would become a very grievous additional pest to those the farmer and fruit-grower already have to contend with. The thing you have to consider is this: From what I could gather from the accounts in the newspapers, three measures were adopted: First, by attempting to destroy the eggs; secondly, by attempting to destroy the caterpillars after they had hatched, by means of arsenical spraying; thirdly, by endeavoring to stop the artificial spread of the pest on vehicles, manure wagons, etc.

Individually I have always felt, and so expressed myself, and still feel, that the proper way would be to use whatever funds the State will give you during a limited time and concentrate all effort and all expenditure in the month of June on the destruction of the caterpillars, and not to bother about the destruction of the eggs or the prevention of the spread of the insect. These latter methods, necessarily intrusted to persons who may be efficient or who may not, are apt to bring the whole subject into popular disrepute and disfavor. You may reduce the numbers but you will never exterminate it by destroying the eggs. Therefore, as a single spraying of a tree will kill five thousand caterpillars just as well as one, there is nothing to be gained by the work of destroying the eggs. Moreover, I do not believe there is much to be gained in the work of preventing its spread by the examination of vehicles on the main thoroughfares and on the railroads. On the contrary, I believe that the only way to accomplish that end is by a very strict law which the legislature should pass, giving the power to some committee to absolutely prohibit the sending of nursery stock or any plant growth or material, probably including manure, out of an infected district without inspection. My belief is that a rigid quarantine law making it a penal offense for a nurseryman to send cuttings or trees from any given infected area without first having the sanction of this Commission would be effective in preventing the spread. That is to say, there should be a competent person or persons appointed to whom all such shipments should be submitted, and only upon their approval should such shipment be allowed to pass out from that area. That would be the only simple and efficient way of preventing its spread.

My impression is that the danger is far greater from overlooking a batch of eggs during the months of the year when such a thing is possible, and of the insects being transmitted in that way, than there would be in the mere carrying of the caterpillars. I would therefore concentrate all efforts on the destruction of the caterpillars. I believe that even in an area as extended as Professor Shaler indicates, if the legislature would appropriate \$100,000, the thing could be done. Let it be used under the intelligent guidance of some one who has had experience, who knows practically how to spray, who can go to work intelligently and instruct his men and have a sufficient force to examine every tree and cultivated plant upon which this insect is known to feed, and make sure that wherever it is it will be destroyed before the change into the chrysalis state takes place. In other words, I do not see why, with \$100,000, a single year ought not to suffice to stamp it out from the area in which you know it to be found. I believe it can be done, and that the State of Massachusetts would be justified in making the attempt. In Europe this injury is at times not great; at other times it is quite extensive; but it is chiefly notable in those places where there are very large areas of cultivated forests. Bavaria, for instance, has lately suffered greatly from it. Experience there has shown that it is easily checked by the use of sticky bands, very much the same methods as you have employed here for the canker worm. They use several kinds of glue (manufactured, and some of them patented by different firms), which is procured in large quantities and smeared on the trees,

being made in such a way that it does not dry. I presume it comes nearest to our printer's roller glue. The caterpillars never pass above it from below. Coming down the tree they jump over it. The devices for putting it on are very simple. That is the method which experience has shown to be the most satisfactory there; but it is a preventive method and chiefly to be considered when you have given up the fight for extermination.

The main thing for you to do is to try to stamp it out during the active season and use all your energies to that end. The arsenicals are not expensive, and if an analysis is made of the Paris green, or whatever form of arsenic is used, to insure its purity, I can see no reason why the whole area should not be practically cleared off during a single season. That should be carefully followed up by close observation, with a view of repeating it in the case of some omitted center or point where they may be found in a subsequent year. In case they have not gone into the woods it seems to me feasible to exterminate them.

I would make one other suggestion, and that is, that as an auxiliary method it would be well to spend \$500 or \$600 in sending one or two persons abroad next summer with no other object than to go to some section of northern Europe to collect and transmit to authorized persons here a certain number of the primary parasites of this species, which are known to check its ravages over there. The insect was undoubtedly brought over by Trouvelot without any of its natural checks. In my judgment it would be well worth trying to import its parasites from abroad. The advantage would be this: If you failed to exterminate it by spraying, its parasites, seeking for this particular host, would be more apt to find the overlooked or escaped specimens than man would.

Professor FERNALD. Do you think that any of our native parasites will be liable to attack this insect?

Professor RILEY. Experience justifies the belief that some of them may, in time.

Professor FERNALD. Have we a case on record?

Professor RILEY. Yes; though they are not numerous. *Pieris rapæ* or the Imported Cabbage-worm has some native parasites. There are other cases, but I should have to consult my notes.*

Professor FERNALD. In reply to the question which was first asked as to whether it is possible to eradicate the insect at all, let me suppose a case. Suppose we have a tree like the elm I see yonder, and suppose we know it to be the only tree in America that is infested. I think you will all agree with me that for a small sum of money the thing could be eradicated. Suppose there were two—suppose all the trees on the common were infested. If they could be eradicated from all those trees it is only a question of time and money to eradicate them from over a much larger territory. It is a question of time and intelligent labor; I say intelligent advisedly. Right here I would suggest very earnestly that the committee or commission should have a scientific man upon it. This is the advice I gave, with all the force I could, to the former commission, for the reason that there are a thousand and one things constantly coming up, where it is necessary for some to know and be able to answer questions.

As to the question of territory, I only raised that to know how it had been determined. It is possible it is not so extensive as indicated; but it may be.

Professor SHALER. I thought it best to put it at the highest figure. My own opinion is that we shall not have to deal with an actual area of more than 9 or 10 square miles.

Professor RILEY. Is it not true that so far you have found this pest chiefly on orchard trees?

Professor SHALER. On orchard trees and elms.

Professor RILEY. That is unfortunate, because it increases the difficulty of treatment.

* Several native species attack *Scolytus rugulosus*. The same is true of the Hop Aphid (*Phorodon humuli*) and of several imported species of Bark Lice.

Mr. CRAIG. They are more numerous on and generally select orchard trees, but even pine trees have been attacked by them and in some cases the branches stripped. Maple trees are also attacked.

Professor SHALER. I have seen them on some maple trees and heard of others, but it seems to be a case of starvation when they come to that.

Mr. CRAIG. My observation is that the older the tree the more they will attack it.

Professor FERNALD. With regard to a scientific man on the commission, if you can get an entomologist who is also a business man you will be fortunate, but in my judgment it is important to have a business man, too.

To go back to the question of territory, I agree with Professor Riley that it is rather stupendous, but if you can destroy the insects over a small area, why can not you over a large one? The whole thing is experimental; it is unprecedented to destroy so large a body of insects over so large a territory, but my impression is that they can be destroyed. The question is, how to do it. I was informed last summer that Paris green destroyed the larvæ of this insect up to a certain size; beyond that size they were able to eat it and grow fat. I urged the commission to try a branch with caterpillars that had not eaten any Paris green, but I can not learn that they did it. If their statements are correct, I must lose the little faith I had in regard to the efficacy of Paris green. My experiments at Amherst on the use of Paris green do not seem to tally with the results they got out of it. They used 1 pound of Paris green to 150 gallons water, and when Mr. Sessions and I went over there in the summer we saw that the trees were burned very little. The same proportions used at Amherst burned the trees very badly. Yet Professor Cook and others have reported that a much larger proportion of Paris green could be used. The Paris green I used I had analyzed, and know just what it was. I expect there is either some great difference between the climate of Amherst and this region or—something else.

Mr. CRAIG. So far as my own orchard is concerned, where the Paris green was used a streak was burned here and there; in other places not. I think it was not kept stirred up.

Professor FERNALD. Suppose it is not possible to destroy the insect? Even then I believe it would pay to make annual appropriations to hold them in check. We know what the farmers are paying annually to destroy the potato beetle, and if this insect spreads over the Commonwealth of Massachusetts I should suppose it was capable of doing more damage than the Potato Beetle. It seems to me if it is not possible to stamp it out it is wise to hold it in check where it is.

Mr. SESSIONS. I have heard the idea advanced by somebody from Medford that possibly the reason the caterpillars apparently eat Paris green and live, is that after a certain stage of their existence they stop eating altogether.

Professor FERNALD. They do not stop eating long before they spin their cocoons. The time is not more than 24 hours.

Professor SHALER. I should like to ask about the chances for more satisfactory insecticides. I should like to ask if we may reckon among the insecticides certain compound salts of calcium which are very acrid, and whether a solution of them would be efficacious?

Professor FERNALD. I have had no experience with them.

Professor SHALER. The question is whether it would serve in this case. Do you know, Professor Riley?

Professor RILEY. I should have most faith in the arsenicals. The relative value of the different forms of arsenic spraying depends partly upon the kind of tree treated, partly upon the condition of the atmosphere, and very materially upon the purity of the material. Paris green has this advantage, that it may be used much more strongly, with less injury to the tree; and it has this disadvantage as compared with London purple or pure arsenic, that it is not soluble in water, and you have to keep stirring it. I have no doubt that the experience Professor Fernald referred to was due to the inferior character of the Paris green in the one case and its purity in the other. It should be applied with a spraying nozzle that would simply touch it to

the leaves, and it should be mixed with a substance to make it adhere. In other words, all this work should be superintended by a careful, practical man, who knows what to do. A part of the advantage of using the arsenicals in this part of the country would be that, aside from the destruction of *Ocneria*, it would pay to use it as against the Tent Caterpillar, the Codling Moth, and various other insects that are so prevalent in your orchards. It is one of the curious things which strike a man traveling through Massachusetts that in a State where applied entomology has had its origin in America an insect as common as the Tent Caterpillar, and which may be so easily mistaken for this very *Ocneria*, should be so abundant, and that so little should be done to control it. You will have the same trouble with the *Ocneria*; you can't get the average Massachusetts farmer to bestir himself about it.

Professor SHALER. Am I not right in supposing that our first care should be to drive this pest in on the periphery at all costs, but to make surest of its destruction on the periphery? The number of inspectors we could have would be limited; therefore we should take the extremest care with the periphery. With that in view, how would it do, from now until the time the eggs hatch (they are conspicuous things; you can see them a great distance, and boys could gather them in quantities), to pay the school-boys what would be a tempting price per ounce for the eggs. We would secure a very large destruction on that basis, I think, between now and the time the eggs hatch. We could put a person in each town, who should gather the eggs once a day, pay for and destroy them. That is, in the regions that are thoroughly infected. In that way I think we should diminish the number that are to be killed in the spring, and that at small cost.

Professor FERNALD. In reply to that, Professor Riley has already expressed his opinion on that point. A year ago I had just the same opinion that Professor Riley has, and expressed it to the commissioners, but they had already gone to work. I talked with some entomologists about it, and they differed from me; they thought it did help to use other means than Paris green. Theoretically, it seems to me that any other means would be a needless expenditure of money, and Professor Riley's suggestion to exterminate them in one year would be greatly to be hoped for, but I question whether it would be wise for us to go from this meeting to the legislature with that proposition. If you don't do it in one year and come back for a second appropriation, you may find it difficult to get it. This is merely a policy suggestion. I can conceive that even with the most thorough work that can be done with Paris green in spraying trees a few might escape and start a new colony. Then in another 20 years this thing would come up again.

Professor SHALER. Do you gentlemen agree that we must look forward to a careful and continuous work against this moth?

Professor RILEY. As I said before, we have nothing to do with the experience or methods of Europe, where the insect prevails over vast areas and where nobody expects to exterminate it. Yet there have been instances of similar extermination, as, for instance, what the Prussian Government did with the Potato Beetle, and here you have an opportunity to show that you can stamp this thing out. I expect a few will escape. That is why I made the suggestion that it would be wise to introduce such parasites as can be used against it, with a view of permitting them to search out those which may have escaped. The matter, as I said, may not be possible, but if it is, it is only possible in that way, and all other efforts would, I think, be rather puerile and serve to bring the whole thing into popular disfavor. Set the school boys to work on the eggs; that is good as a prophylactic measure and would do a certain amount of good, but the good would be very slight as compared with the effective work you ought to do in the actual destruction of the caterpillars. As I said before, the fact that the insect has been diminished in numbers would be rather against the efficient extermination of the larvæ in summer, for the reason that it is harder to find an isolated bunch of caterpillars in a county than when they are numerous. I still hold to the belief that whatever funds the legislature can give you should be devoted to a prompt and effective attempt at stamping out.

Professor SHALER. Suppose every tree sprayed, what reason have we to believe that we should have disposed of the pest?

Professor RILEY. There would be need for some years afterward of the greatest care. I would not attempt to kill the young caterpillars; wait until they are somewhat advanced, so that the work could be concentrated within a narrow limit of time.

(At this point Mr. Scudder came in.)

Professor SHALER. The discussion has been, Mr. Scudder, on the question as to whether it would be well to proceed at once to the destruction of the eggs. There are places where the eggs are abundant, and, as we know, they are conspicuous, and it seems that between now and hatching time we might collect a considerable per cent of them, paying for them by weight or measure, and at once destroying them. Professor Riley thinks that would diminish the conspicuousness of the colonies, so to speak, and make it harder to find them, and thinks that an equal amount of money would go further in poisoning with spray than it would in collecting the eggs. I should like to hear from Mr. Scudder what he thinks about the desirableness of doing anything with the eggs.

Mr. SCUDDER. I feel that I have no right to speak in the presence of others here who have given special study to economic entomology, while I have not. All I can speak upon is the natural history of the moth, and on that side of the question it might be well to ask whether it is behaving the same in this country as in the old country. There are a number of moths single brooded in the old country which are double brooded here.

Professor RILEY. I have assumed that it was single brooded.

Professor FERNALD. I have bred it twice, two years in succession.

Mr. SCUDDER. If it is single brooded there is this point to be brought out, that as the caterpillar is a very liberal feeder, so, of course, it is very much more difficult to reach by spraying, because the spraying is not to be confined to a few kinds of trees, but to a very large number, so that one would say you would have to spray almost everything you came across. So with the eggs, which are laid not always on trees, but on almost anything else. It therefore becomes the most dangerous insect enemy we have had for a long time, I think. If it is single brooded it seems to me that nature has indicated the easiest means of attack. The eggs are laid in batches and are exposed for eight months of the year. Therefore it seems to me that the eggs are the place to attack. I should suppose that the same amount of money expended in the destruction of the eggs would effect a very much larger end than the same amount of money spent in spraying.

Professor RILEY. I have been trying to bring out what knowledge there is as to the actual range of the insect, and my remarks on the possibility of stamping it out have all been based on that. I want to say that if the insect has spread beyond the limits indicated by Professor Shaler and got into the larger trees I think the question of stamping it out a very doubtful one. At the same time there is an opportunity here for the State of Massachusetts to make the experiment and show what can be done by efficient means and intelligence. I would rather offer a higher bounty to every schoolboy for pointing out where the caterpillars are to be found during two weeks in June than for gathering the eggs. I believe that there is a chance of stamping it out if it is not beyond the region where the trees are comparatively few in number and not very large.

Professor SHALER. How would it do, as one of the early steps in this work, to get all the information we can as to the periphery and publish maps showing it? Let us ask for information as to the spread of the pest beyond those limits. I should hesitate about offering a reward for the location of the caterpillars, because there is the possibility of the schoolboys planting them. A reward for the eggs is much more easy, and we could probably interest the schoolboys in searching for them, but it would hardly do to offer a reward which might serve to spread the plague. All these rewards for animals are very dangerous.

Professor RILEY. On general principles it is bad policy, but the same objection would apply to a reward for the eggs. If the boys once learned that they could get a certain amount of money for the eggs, they would not be so interested in exterminating them and thus cutting off future revenue.

Professor SHALER. I should state a definite reward and not go beyond a certain time.

Mr. CRAIG. We have two or three village improvement associations especially to take care of the trees. We extended an invitation to the citizens to take part in the work, and they were to notify certain committees wherever they found any eggs. This was done to a large extent, and I think it aided the commissioners very largely in finding out where the moths were.

Professor SHALER. You can tell us about the extent of the pest in Medford. Over about how large a territory did it extend?

Mr. CRAIG. More or less from the Malden line over to Arlington.

Professor SHALER. About a mile and a half in the worst infested district.

Professor RILEY. What was the result of the commission's work? Are the eggs found abundantly in that neighborhood?

Mr. CRAIG. I don't believe there are one-tenth the eggs there were when the commission commenced.

Professor RILEY. What was the result of the commission's work last year? Was it appreciable on the number of eggs known to have been there?

Mr. CRAIG. Yes, certainly. I differ from you two gentlemen about destroying the eggs. I think it was the means of destroying a great many of the pests. On many trees it was controlled by gathering the eggs.

Mr. SESSIONS. I have no scientific knowledge on the subject, but it seems to me the first and most important thing we have to do is to find out the outside line, even if we don't do any more than that in one season. The old commissioners claim that they have found it; our first business should be to verify that.

Professor SHALER. Did they make a map?

Mr. SESSIONS. I think not.

Mr. SCUDDER. How do they know the moth wasn't blown 50 miles away by a storm?

Professor SHALER. It may have been. But it is a strong point in our favor that after the creature has been 20 years on the scene it still has a tolerably distinct periphery.

Professor RILEY. That is what I have based my recommendation to exterminate it upon. I should not like to see the attempt abandoned, but my remarks have all been made with a view of economizing means and time in one effective effort to exterminate it. All these other measures will come in if we have to deal with the pest as a permanent thing among us. As a mere State measure, with a view to not having the unenviable reputation of having given a pest to the rest of the country, or done nothing to prevent its spread, Massachusetts has an excellent opportunity of showing what may be done by intelligent concentrated effort. All other means are puerile as compared with destruction by the arsenicals. All other means are now abandoned in fighting the canker worm, the codling moth, and some other insects, and intelligent spraying at the proper time has come to be looked upon as the most efficient means of protection against these insects. My idea is that what you ought to do is to employ a sufficient force of intelligent persons to scour that whole region in the month of June, and indicate every plant that has a brood upon it.

Professor SHALER. Suppose you had 100 persons searching at the same time. What general instructions could you give them in determining what trees were infested?

Professor RILEY. The insect is gregarious and therefore conspicuous. There is no reason why intelligent search should not detect it, even on the highest trees.

Professor SHALER. How much time could you reckon on having for your search after the creature came out?

Professor RILEY. I should say you could count on 10 days after it was hatched. Its gregarious nature makes that feasible.

Professor SHALER. How much time is there before it begins to spin?

Professor RILEY. I believe it takes 3 or 4 weeks.

Professor FERNALD. I think it highly desirable to make the attempt to stamp it out. I don't know that it can be done, but it is worth trying. If we can not exterminate it, the other excellent remedies will come in in holding it in check.

Professor SHALER. Had we not better wait until we can strike a hard blow and do the best we can this year with prevention?

Professor RILEY. I am strongly of opinion that you had better not wait. Some contingencies may arise to give it a sudden impetus. I would adopt the auxiliary methods of introducing parasites, etc., and I would also have a special committee authorized to inspect all nursery stock that goes out from the infested region and not allow it to go until passed upon by competent men.

Professor Fernald thought the Federal Government might take charge of the work. Professor Riley stated that he would be glad to assist in any way possible, but that since the establishment of State experiment stations, the Federal Government felt it had no further function in the States, so far as local insects are concerned. Professor Shaler thought the State of Massachusetts should make the fight itself, and only ask for Federal aid in case it could not exterminate the pest; \$24,000 were on hand, and he thought \$25,000 or \$50,000 more could be counted on from the legislature.

Mr. SCUDDER. I don't understand the force of the arguments used by my neighbors on either side (Professors Riley and Fernald) of delaying the work by not taking the eggs at present. Why do they want all the caterpillars out that they can get, in order to exterminate them?

Professor SHALER. It is a question of seeing them, I believe.

Mr. SCUDDER. I understand. But if you destroy so many eggs that, say, only one tree out of five is attacked, you have to deal with only one-fifth as many trees in spraying.

Professor RILEY. I want to tell Mr. Scudder just why I rather urge the policy I have advised. First of all, it is from the political side. If you ask for an appropriation to stamp it out, you must do your best to stamp it out. As Professor Fernald has suggested, it is simply a question of means, and I would not think of asking for less than \$100,000, and I would concentrate that where it would do the most good. Killing the eggs is frittering the money away at a time when it is not of so much value as if concentrated. Secondly, I have little faith in the destruction of eggs in this case, where they are laid on so many different objects. I remember distinctly a little cedar tree not more than 6 feet high, in my own grounds, that was attacked by the Bagworm. I thought I would see whether I could not clear them off. I worked for two consecutive months picking off from that tree the issue of not more than two females. Almost daily I went to that tree and found fresh specimens that I had overlooked the day before, yet in the Smithsonian Grounds I have absolutely stopped similar injury on large trees in a few minutes by spraying. It would have been of no use, in my judgment, to have attempted to eradicate them by hand picking. Suppose you have somebody climb a tree and gather twelve batches of eggs, but he fails to get the thirteenth. It will cost no more to spray a tree for the thirteen batches than it will for the one.

Professor SHALER. When I came here I was strongly in favor of offering a reward for the eggs, but I admit I am shaken now.

Mr. SCUDDER. I don't think you can get sufficient force to spray the trees thoroughly in the time allowed.

Professor SHALER. I think we shall have to ask the Agricultural College to lend us say 80 or 100 of their young men for this work.

Mr. SESSIONS. There are many people living in the neighborhood of this spraying

who claimed that it was of no sort of value. Do any of these gentlemen believe that?

Professor RILEY. I think the reasons that have been given explain why they had that experience. It was simply due to the impurity of the Paris green and the imperfect manner of applying it. You will always have more or less of failure until you put this matter into the hands of men who can give their whole time to it during that period. Only those men should be employed who have ability and experience, and one man, particularly, should be engaged to superintend the whole work, and as many other competent persons as possible.

A tree 50 feet high is very easily sprayed. If the caterpillars could not be killed by spraying, it would be better to cut the trees down over the whole of the Middlesex Fells. It pays better to make one grand effort than to fritter your energies away over a number of years and then fail. The board in control of the work should control everything. If Paris green is used, it should all be issued by the board, after being tested.

Professor SHALER. I should like to ask your opinion, gentlemen, whether any considerable risk to health is to be apprehended from this large use of arsenic in the country. Is there any risk of poisoning the water or of poisoning animals or men?

Mr. APPLETON. The committee on public health is having an extended hearing on the use of arsenicals.

Professor RILEY. If the spraying is copious and careless, which is unnecessary, there is danger of stock feeding upon grass which has been so impregnated, but there is no necessity for that. The spraying should be of such a character that there would be comparatively little falling from the tree or shrub sprayed.

Professor SHALER. Have you known any cases of poisoning in persons employed in spraying?

Professor RILEY. No, I have seen none, but I have known of cases where negroes would sit on the back of a mule with spraying pumps, going through cotton fields, and carelessly allow the water to fall on them. I have known them to become sore in the groin, but never knew of a fatal case.

Mr. APPLETON. The spraying is washed off by the first rain of course?

Professor RILEY. It should not be. The whole tree is enshrouded in a vapor which is all-sufficient, and which is more effective than a more copious spraying.

Professor SHALER. Is there any particular form of engine which will give that form of spraying?

Professor RILEY. There are various spraying devices in use, depending largely on the height of the vegetation. If you want to throw to any great height without the use of ladders, you need a spraying device that will throw a strong jet. In almost all cases you can use the cyclone nozzle in its Vermorel modification.

Mr. SCUDDER. I should like to say, before going, that it does not seem to me likely that the thing will be exterminated, but that it can be held in check for many years. The reason why I don't think it can be exterminated is because we have not got enough persons used to looking for the caterpillars, to examine the trees and say for certain that there are none there. I do think, however, that it can be held in check.

The MAYOR OF ARLINGTON said they had had very little trouble with it in his neighborhood. The sentiment of the people there was in favor of the continuation of the work.

The MAYOR OF MALDEN. We went through and marked every tree that was infested and then went through again and sprayed them. The trees were not so infested as to be particularly noticeable.

The MAYOR OF MELROSE. The selectmen did not believe there were any Gypsy Moths in their town. As far as he knew, the people were not disturbed by their presence. They would be glad, however, to have the inspectors go through the town and look for it, and would gladly second their efforts.

Professor SHALER. I think it would be a tax of probably more than \$100,000 annually if not checked.

Professor RILEY. There is no question of that, if it is allowed to take its course. That is what makes it so vitally interesting to me, and why I am so impatient of any effort to simply check it. I have nothing to say about checking it; I speak for stamping it out. Mr. Scudder simply says he doesn't think it will be exterminated. As to how much of any given territory one individual is capable of critically examining, a man who is capable of distinguishing between this caterpillar and others, doing nothing else, would, in my judgment, be able easily to go over a square mile of ground a day, except in dense forest.

Professor SHALER. I don't think so—nothing like it. If the work was done closely (and two together would do better work than one) my impression is they would be doing good work to get over 100 acres a day.

Professor RILEY. Well, say 100 acres—

Professor SHALER. If we could get from the college say 40 young men as inspectors, we would have 4,000 acres a day inspected, and my impression is that the region covers about 10,000 acres. That area can be thoroughly inspected by 20 parties of selected men doing nothing else. They should mark the infested trees and plat them on a map. As we are no longer a paid commission, I would devote that money to experts. We want the best expert we can select to superintend the actual application of the remedies. When a tree is marked as infested, let it be numbered so and so, and when it is sprayed, let an account be taken of that tree, so that by some system of checking we can find whether every tree has been disposed of or not.

Professor RILEY. The suggestion seems to me eminently wise. But I suppose you could get the leading citizens in a community interested also?

Mr. SESSIONS. I don't believe you can get the college boys to come.

Professor RILEY. Not if you paid them? It would be an excellent education for agricultural students, and if you offered them \$100 each you would have no difficulty in getting them, I think.

Professor SHALER. What month should the work be done in?

Professor RILEY. As far as I can learn, the month of June. I believe that about the second week in June will be the time to strike, after having made all your plans, got your forces ready, and trained your men. It may be that the thing is not practicable, but I can see nothing impracticable. It is simply a question of money and men. After this one thorough effort you need not ask for another appropriation; everybody will be interested, and then you could afford to offer a big reward for any eggs that might escape. The attempt is well worth making.

Mr. SESSIONS. A great obstacle is in procuring help you can depend on.

Professor RILEY. Let me make one other suggestion: While the infested area is stated in the rough at 50 square miles, from what Professor Shaler said, there would probably be large portions of it that would require nothing but inspection. Now, wherever there are large trees difficult to climb, I would certainly take the precaution to ring or band them, because that will prevent any stray caterpillars from climbing up those trees. No caterpillars will ascend such trees, and if any escape, you will find them at the foot of the trees. European experience shows this.

Professor SHALER. Where can we get on the track of the mixture they use in Europe for that purpose?

Professor RILEY. You can use printer's ink for that purpose. In Newark I recommended the use of the fire department for spraying certain very tall elm trees.

Professor SHALER. I presume we could make such an arrangement with the fire departments.

Mr. CRAIG. We have an engine that could be so used.

Professor RILEY. I would modify my objection to egg collecting just so far that in the case of large trees it would be advisable to do the work prior to aestivation. I think boys could go over them, and in this direction winter work would be advisable. It would also be advisable to have these large trees very carefully inspected for the eggs, but I do not believe you would be justified in attempting to destroy the eggs over the whole area.

Professor SHALER. Is the energy of diffusion and the tendency of the females to travel at all proportioned to their numerousness?

Professor RILEY. Yes; it is a general principle with insects that in proportion as they become unduly multiplied the migratory instinct is developed.

Professor SHALER. So that in so far as we reduce the number in a given field we tend to reduce the expansive energy?

Professor RILEY. Without doubt.

Professor SHALER. And therefore if we fail to exterminate it this year we shall at least diminish its expansive energy.

Professor Riley described the Cyclone nozzle, stating that it is not on the market, but is easily made by any good mechanic. Thomas Somerville & Son, of Washington, are constantly supplying it. Professor Riley recommended the Vermorel modification.

At 6 p. m. the conference adjourned.

THE RAVAGES OF *LIPARIS* (PSILURA) *MONACHA* IN GERMANY AND MEANS OF DEFENSE.

[Author's abstract of a paper read by B. E. FERNOW before the Entomological Society of Washington, March 5, 1891.]

Mr. Fernow spoke of the alarming increase of *Liparis monacha* in Germany, and especially Bavaria, during the last year and the anticipations of still greater damage in 1892, and hence the diligent search after effectual remedies. He pointed out that such ravages in German pine and spruce forests meant not only many thousands of dollars loss in depreciation of wood values, but also most inconvenient disarrangement of working plans, which are necessarily laid for 100 or more years in advance.

He referred to the last great ravages of this insect, which involved an area of over 100,000 square miles and to which 55,000,000 cords of wood succumbed in the spruce forests of eastern Prussia during the years 1853-'67, necessitating the premature cutting of 7,000,000 cords of wood to save it from subsequent attacks of Scolytids. In the present case some 20,000 acres of spruce in Upper Bavaria were first attacked, but soon reports from all parts of Germany, Austria, Bohemia, etc., indicated unusual increase, so that many thousand square miles of forest are involved. In the first-named district over \$8,000 were spent toward checking the damage.

A special commission has been appointed by the Bavarian Government to discuss the measures to be taken against the further spread of *Liparis monacha* and the amount of observations and intelligent preliminary discussion of measures in the "Programme for the Commission" is said to be one of the most comprehensive works touching such a subject.

Of the life history of the insect Mr. Fernow pointed out only the following notes of interest:

Like most of the North European Bombycids, it has but one genera-

tion per year, and since as many as 150 eggs may be laid on the average by one female, there would seem to be ample provision for its propagation. Nevertheless the insect has been in many localities so rare, that in 50 years in one district hardly a specimen for collection could be found, where now millions suddenly have made their appearance. The reason for its sudden multiplication is sought in climatic conditions (rains), which were unfavorable to the Tachinæ, Ichneumonidæ, and other parasites without impeding the development of Liparis.

As reasons for the rapid spread from a center of first development and the infesting of areas formerly unoccupied by the insect were cited voluntary and involuntary migration of both imago and larva. Involuntary migration, or drifting by wind over large distances, has been definitely observed, while the larva is wafted by the winds when suspended by its threads in the early and also later periods of its life. Rains also bring it to the ground. There are also observations extant which would prove voluntary immigration of the imago and a normal progress of the exceedingly mobile larvæ from thinned-out fields of attack to the unattacked shadier surroundings; the observation of Altum, however, that "the insect rarely feeds in the same district two years in succession, and that hardly any eggs are found in the thinned-out parts, the insect seeking the shadier outskirts for oviposition," does not seem to hold for spruce forest. For oviposition it seeks the scaly bark of pine and spruce, under which the eggs are inserted; the smooth bark of beech, on which the insect seems to develop better than on conifers, does not offer a good place for oviposition. Three hundred larvæ, 3,000 pupæ, and up to 140,000 eggs could be counted on a tree. The insect is polyphagous, almost omnivorous, but it is considered dangerous only on spruces, which are apt to die from its attacks. One additional reason for the rapidity of defoliation is that the larva bites off the needle half way up, so that the upper half falls to the ground and is wasted.

Of interest entomologically is the appearance of a black variety (var. *eremita*) in certain locations, and also that at first the males are in preponderance, and remain so in proportion of 70 per cent to 30 per cent of females.

The most important biological feature of economic interest is the tendency to migration and great mobility of the larva, which gives indications for the methods of coping with the pest.

Various methods of checking the ravages have been proposed and practiced. The sweeping and collecting of larvæ are found ineffective on account of numbers, and undesirable because enemies are destroyed at the same time; gathering of eggs, because all over the tree, high up, and difficult to get at; collecting pupæ, too few on the ground; breeding of *Tachina monacha*, too difficult and uncertain. Ditches have been found a good aid to check migration of the larvæ and confine it. One of the most ingenious but costly and ineffective propositions has

been the steam and electric exhauster, the invention of a Socialist, an illustration of which was shown. It consists of a 28-inch iron pipe, carried up between four trees above their tops, carrying a horizontally revolving funnel 52 inches diameter, in the center of which an electric lamp with reflector is placed for the purpose of attracting the moths. At the bottom of the pipe a locomobile creates a draft to suck down the insects. Since one of these machines costs about \$8,000 and the working of one sample machine \$1,500, and the result being unsatisfactory, it is not likely to become useful. Zinc lights, costing 40 cents and burning one-quarter hour, were found too expensive. With 24 lights in two hours from 10,000 to 15,000 moths were gathered at each shield, and such a light in not too dense forest is effective for about 1,000 feet circumference. In the beginning of the flight the effect even of common fires was satisfactory; many fires, of course, being superior in effect to one strong source of light. The following record of one night may be of interest:

Date.	Time.	Remarks.
July 22, 1890	8:15 p. m.	Lighting of fires. Light west breeze. No flight observed.
	8:45 p. m.	Light rain. A few moths.
	9:15 p. m.	Flight more numerous, especially females.
	9:45 p. m.	Increased flight, like snowstorm. Very many females. Wind changing to south.
	9:50 p. m.	Flight suddenly increased from east and northeast; more males, yet still many females.
	10:00 p. m.	Increase of males.
	10:15 p. m.	Most of the moths come against the wind through the smoke; only single ones with the wind and more from above.
	10:40 p. m.	Very great increase from northeast; 40 per cent. females.
	10:50 p. m.	Decrease.
	11:10 p. m.	Almost entirely stopped. Suddenly a new flock, like snow, from northeast; almost all male.
	11:30 p. m.	Flight increasing, although fire low; almost all males.
	12:00 p. m.	Sudden squall of rain; fire out.

The only really effective remedy so far found against this, as well as a number of other insects, like *Ocneria dispar*, *Cheimatobia brumata*, etc., is the "insect lime," and in this particular case the "lime band." For *Ocneria dispar*, the Gypsy moth, the use of the "lime" applied to the egg patches has been found of great effect. The "banding" consists in smoothing the bark breast high around the trunk, if necessary, and spreading over the smooth surface a band of specially prepared glue, about 2 inches broad and one-fourth of an inch thick. This work is done from May to June, and the period of its utility is passed by middle of July. At the same time all underbrush which may serve as food to the descending caterpillar is removed, and the result is starvation of the larvæ. The object of the lime band is *not* to catch the larva, as is currently believed, but to *prevent its ascent*. While the use of tar dates back to the beginning of this century, or earlier, and was practiced in the forest against the "Nun" (*Liparis monacha*) in 1834, and is now regularly employed against *Gastropacha pini*, its advantages against the former insect are only now fully recognized, and the

method of its application perfected by improved material and instruments. Three or four firms manufacture an insect lime which answers the requirements, namely, that it keeps effective for 3 months; that it does not run in hot weather, and preserves the original dimensions of the band; that it is lighter than water (to show it free from heavy admixtures which injure its usefulness); that it preserves a disagreeable smell (tar oil), which seems to keep the larvæ off. The price is less than \$2 for 100 pounds. The cost of banding 1 acre of forest by hand, without the new machines, is \$1.80, of which \$1.25 goes for material, 25 cents for bark scraping, and 30 cents for putting band on trees. With the newly patented bark scraper and gluing machines (illustrations of which were exhibited), the cost may be reduced by one-third to one-fifth, with more effectiveness in addition.

The success of the "lime band" was demonstrated in a district of about 2,000 acres at an expenditure of \$12,000, experimentally, including the cutting of infested trees, etc. The larvæ accumulated below the bands by the thousand and could be killed easily or starved to death. Those that were on the trees in descending, let themselves drop over the impediment. The next year will furnish a still larger amount of experience in fighting the pests.

Mr. Fernow also suggested that the introduction of insect lime into this country might be desirable as an additional cheap means of protecting orchard and park trees. This lime is manufactured by L. Pohlborn, of Berlin, and Schindler & Mützell, of Stettin, previously mentioned on page 36 of the current volume, and by other German firms.

A NEW SCALE INSECT FROM CALIFORNIA.

By D. W. COQUILLETT, *Los Angeles, Cal.*

Lecanium pruinosum n. sp.—Adult female pale brownish, thinly covered with a whitish powder which does not conceal the ground color; body oblong in outline, very convex above, not distinctly carinate, the surface very uneven; margins nearly perpendicular; dimensions as follows: Largest specimen, length 7 millimetres, width a trifle over 5 millimetres, height 3 millimetres; smallest full grown specimen, length 4 millimetres, width 3 millimetres, height 2 millimetres; antennæ much thickest at the base, 7-jointed; joint 6 the shortest, then 5, then 1 and 2, which are subequal in length; joints 3, 4, and 7 are also subequal in length, each nearly twice as long as 6; joint 7 tapers to the tip, and is furnished with a style inserted to one side of the extreme tip, the style being about three-fourths as long as this joint; anal cleft and lobes normal.

In the old dead and dried scales the powdery substance becomes almost entirely removed, and the surface becomes rougher, especially along the sides, where it is very rugose, the center of the dorsum always being smoother than the sides; the margin usually becomes thin and spread out, forming an acute angle with the bark upon which it rests; the color of the scale is now a reddish-brown.

The females become full grown early in summer, and the eggs are laid during the months of May, June, and July; these are of the usual ovoid form and of a yellowish-white color. They hatch out in a few weeks after being deposited, and the young larvæ settle down upon the under side of the leaves, arranging themselves in various positions without any regard to the veins or midribs. Larvæ which I found September 3, on the under side of the leaves of an ash tree (*Fraxinus* sp.), were of a paler green color than the leaf itself, being nearly concolorous with the midribs and larger veins; they have a distinct dorsal ridge extending the entire length of the body, and with many smaller ones (about 24 on each side) extending from it to the margin, some of them being divided into two branches. The margin itself is furnished with a row of bristle-like appendages, and the ordinary four lateral notches are present besides the anal cleft with its two accompanying lobes.

At the approach of the winter season and before the leaves have fallen from the trees, the larvæ migrate to the twigs and smaller branches, usually selecting those of the last season's growth; here they settle down invariably upon the under side of the twig or branch. A large number of these larvæ which I found March 4, on twigs of ash trees were of the same general form as those above described, but the color is now a deep, brownish red, with the legs and antennæ pale yellow; the body is now nearly 1 millimetre long, evenly convex above except for the dorsal ridge, twice as long as wide, and the appendages of the margin are of various shapes, the greater number of these being broadest at the middle. On each side of the body is a submarginal row of about five long bristles, but these are easily broken off, and it is difficult to find a specimen with more than three of these bristles intact. The usual lateral notches are very shallow and are usually filled up with a whitish exudation. On April 4 I found a great many of these scales on a branch of an ash tree and a majority of them were over half-grown.

I first found specimens of this scale on apricot trees in this city; this was in the summer of 1887, and at about the same time Mr. Alexander Craw, of this city, also found specimens of this species, some of which he forwarded to Prof. J. H. Comstock, our best authority on this group of insects, and Professor Comstock replied that they evidently belonged to a new species, for which he proposed the name of *Lecanium pruinosum*, or the "Frosted scale;" but I am not aware that he has published a description of it up to the present time. Among all the descriptions of the species of *Lecanium* to which I have access, none agree so well with the present species as does Dr. Fitch's description of his *Lecanium caryæ* (Transactions N. Y. State Agricultural Society, p. 443); but Professor Riley, who has compared specimens of the present species with Dr. Fitch's type specimen, writes me that the two species are quite distinct and that *caryæ* is much larger than *pruinsum*.

In Los Angeles County I have found full-grown specimens of *prui-*

nosum on the following-named trees: Apricot, prune, peach, cherry, English laurel (*Prunus lauro-cerasus*), pear, apple, English walnut, birch (*Betula* sp.), and ash (*Fraxinus* sp.); and Professor Riley writes me that it has also been found on grape vines at Berkeley, in this State. Some of the trees which I examined were very thickly infested with these scales, and as no insect is known to attack them, they may yet develop into a very serious pest. A single experiment that I made last season, however, would seem to indicate that on dormant deciduous trees these scales, all of which at this season of the year are in the larva stage, could be readily destroyed by means of a wash or spray composed of the following ingredients: Resin, 30 pounds; caustic soda (about 70 per cent. strong), 9 pounds; fish' oil, 4½ pints, and water sufficient to make 100 gallons. On the 12th of May I sprayed some of this solution on a few branches of a prune tree which were thickly infested with these scales, and this proved fatal to all of them, besides destroying the greater number of their eggs. This wash, however, could only be used while the trees are dormant, and should never be used when the young buds are bursting forth or at any time when the trees are in leaf.

NOTES ON THE HABITS AND EARLIER STAGES OF CRYPTOPHASA UNIPUNCTATA, DON., IN AUSTRALIA.

By HENRY EDWARDS, *New York City.*

One of the most singular instances of the change of habits in a species of Lepidoptera that has come under my notice is to be found in that

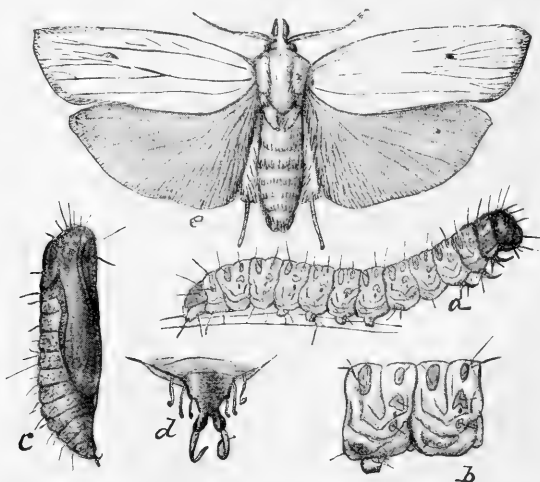


FIG. 30.—*Cryptophasa unipunctata*: a, larva; b, lateral view of enlarged segments; c, pupa; d, anal segment or cremaster; e, adult—all natural size except b and d, which are enlarged (original).

of the insect referred to in the present article. As far back as 1858 I was fully acquainted with the species, and raised a considerable num-

ber to the imago state. It was then only to be found on the Black Wattle, *Acacia decurrens*, the larva burrowing into the stems and younger branches, but, as far as my observations went, never attacking the trunk or the larger arms of the tree. It was not unusual to find specimens in the very early morning, *i. e.* at 5 or 6 a. m., at rest upon the leaves of the wattle, but later in the day they hid themselves from the sunlight and were very rarely met with. On my return to the colonies during the past summer, I was led to observe that many fruit trees in the garden of the Hon. George Coppin, at Richmond, near Melbourne, had been attacked by some pest, and were rapidly approaching destruction. Close investigation displayed the fact that some burrows had been made in the trees somewhat similar to those of the Cossidæ, the entrance to these burrows being artfully concealed by a small cap of fragments of wood and bark so closely cemented together as to appear like a portion of the bark itself. Upon cutting down one of the diseased branches and splitting it open, I found that the burrow passed at right angles to the very heart of the branch, and thence downward for a space of 15 or 16 inches.

At the bottom of this burrow I found a full-grown larva, which, when disturbed, wriggled itself about with very rapid movements, crawling up and down its burrow with surprising quickness. Below the home of the first insect noted was another burrow of 12 inches in depth, and in this I found a healthy pupa, equally with the larva disinclined to leave its resting place. Wherever throughout the garden a dead branch was to be seen, it was always found to contain one or more of these insects in either the larva or pupa state, and their number can be guessed at when I say that not less than thirty trees had been more or less attacked by this destructive species. Those most affected were cherry, plum, apricot, nectarine, peach, and quince, but I found also one pear tree containing a larva, and it is possible that in the course of a short time the apple trees may also suffer. As in the Cossidæ, *Ægeriadæ*, and other internal feeders, the pupa when near the final change, works its way to the mouth of the burrow, and the moth as it emerges softens the cover of chips with which the entrance is closed, and so makes its escape. The pupa does not protrude, as is the case in the above mentioned families, but remains a little distance within the opening. The moths emerge from the pupa about 6 or 7 p. m. and may be found adhering to the branches, often *in copula*. They are easily attracted by light, and no less than eighteen fine specimens were taken in one evening at a lamp placed rather high in the house. They are exceedingly delicate insects, and are easily killed in the cyanide bottle, usually dying in from 20 to 25 seconds. Great care has to be exercised in handling them, as the fine silvery white scales are very readily removed. The genus appears to be distinctly Tortricid, and has nothing in common (save its method of burrowing) with the Cossidæ, in which it has been placed by some authors. The following descriptions apply to the stages in which I was enabled to observe it.

Larva.—Full grown. Tortricid in form, the head tapering in front and truncate, pitchy, rugose, with slightly dorsal channel. Mouth parts ample. Upper side of body, except the second segment, which is pitchy, dull pale chocolate brown. Under side sordid white. Spiracles pale pitchy, as are also the thoracic feet. On the dorsum series of double ovate shining spots, placed transversely, a little darker than the ground color. These spots differ in intensity in various individuals. There are a few short hairs upon all the segments, and especially about the head and anal extremity. Length, .35 millimeters.

Pupa.—Cylindrical, rounded in front, and tapering suddenly posteriorly. Color, bright chestnut-brown in life, changing to pitchy. The head, thorax, and wing cases darker than the rest. Surface very much roughened, the head and thorax being covered with transversely waved ridges. The abdominal segments are also wrinkled, but less rugosely. Wing cases broad, smooth, glossy, those of the antennæ being strongly defined. Anal segment rounded. Cremaster short, bifurcate, Length, .23 millimeters. Width across the wing cases, 8 millimeters.

This pretty species must now be included among the most injurious insects of Australia, and as it is eagerly sought by collectors, its numbers may be easily kept in check. I have seen it in two collections marked *Morgia gigantella* Walk.

STEPS TOWARDS A REVISION OF CHAMBERS'S INDEX, WITH NOTES AND DESCRIPTIONS OF NEW SPECIES.

By LORD WALSINGHAM.

[Continued from p. 329.]

ARGYRESTHIA Hb.

Argyresthia plicipunctella Wlsm.

Hab.: Head of Noyo, Mendocino County, California, 8-11 June, 1871 (5 specimens). Crescent City, Del Norte County, California, 22 June, 1872 (1 specimen). Rouge River, Oregon, 7 May, 1872 (1 specimen).

The localities where this species was captured were inadvertently omitted from the description* [INSECT LIFE, III, 120, 1890].

COPTOTRICHE Wlsm.

Coptotriche zelleriella Clem.

Tischeria zelleriella Clem.

= *complanoides* F. and B. (*zellerella* F. and B.).

I have now the female of *Tischeria complanoides* F. and B., which distinctly confirms my previous impression that this is truly *Tischeria zelleriella* Clem. The dark gray hind wings of the female are very noticeable, and the hind wings of the male in bred specimens entirely answer to the description of Clemens, printed in italics, "tinted with yellow externally towards the tip."

I had observed that Frey and Boll had overlooked the peculiar form of the hind wings of the male when describing the species under the name *complanoides*. This is now accounted for by the fact that the female only appears in Frey's collection, whereas the male has turned up from Zeller's collection received from Boll in 1873, labeled "*zellerella* Cl. Fr. E. Z., 73, 220. Boll lit. 4, 73."

COPTOTRICHE Wlsm.

1. *zelleriella* Clem.

Tischeria zelleriella Clem. (1859).

= *Tischeria complanoides* F. and B. (1873).

= *Tischeria zellerella* F. and B. (1873).

= *Tischeria latipennella* Chamb. (1878).

TISCHERIA Z.

Since the late Professor Frey's types have come into my hands I have gained much information about this genus and have at least one important correction to make in my previous notes.

1. *Tischeria citrinipennella* Clem. ♂

= *quercitella* Clem. ♀

= *quercivorella* Chamb. ♂ ♀

2. *Tischeria badiella* Chamb.

= *citrinipennella* Stn. and Wlsm. (*nec* Clem.)

= *sulphurea*, Wlsm. [INSECT LIFE II, 324 (1890) (*nec* Frey).]

The specimen which I supposed to be *citrinipennella* Clem., as compared with the type in 1871, exhibits no signs of the fuscous patch at the base of the hind wing, referred to in the description of that species.

The specimen sent by Clemens to Stainton under this name agrees with mine and also wants this character although both are males.

These two specimens have the faint gray spot at the anal angle of the fore wings noticed by Stainton in his republication of Clemens's papers [Tin. N. Am, p. 39, and foot note p. 82 (1872)] on which I had partly relied for the identification of my specimen.

This distinguishing mark was not referred to by Clemens, and considering the number of closely allied species of this genus which have since been found in the United States it is extremely probable that Clemens had more than one species in the series from which he selected the example sent to Stainton.

The only species known to me (and I have a large amount of material for comparison) in which the fuscous patch occurs at the base of the wings of the male (not in the female) is *quercivorella* Chamb., while the only one of the pale yellow oak-feeding species which possesses the dark scaling at the angle of the fore wings is *badiella* Chamb.

It is therefore more than probable that *quercivorella* Chamb. equals the true *citrinipennella* Clem. [indeed Chambers himself seems to have had a strong suspicion of this synonymy (Cin. Qr. Jr. Sc., II, 110), and I have had it from larvae received as *citrinipennella* from Miss Murtfeldt], whereas *badiella* Chamb., although in Clemens's possession, was not specifically described by him.

I have already identified *quercivorella* Chamb. as a synonym of *quercitella* Clem. [INSECT LIFE, II, 324 (1890)] which was described from a single crippled specimen. It was not surprising that Clemens should have failed to recognize the female of his *citrinipennella* in a specimen absolutely devoid of the characteristic dark patch which distinguishes the male. Female specimens from Frey's collection and Zeller's are labeled *quercitella* Clem. and correspond with those females which I have bred from the same mines as produced typical males with the dark patch.

Tischeria sulphurea Frey.

The hind wings of the ♂ are broad and evenly lanceolate and the costal cilia are brownish fuscous for three-quarters of the wing-length, but especially from the base. The fore wings possess a thick mat of coarse, closely appressed scales on the under side along the discal cell. It is remarkable that Frey should not have observed that the

gray tint to which he refers was caused by this abnormal scaling. I have his labeled type (♂) before me. The specimens referred by me to *sulphurea* [INSECT LIFE, II, 324, (1890)] were wrongly identified; they are *badiella* Chamb.

***Tischeria clemensella*, Chamb.**

Tischeria clemensella, Chamb. Bull. U. S. G. G. Surv., IV, 98-9. (1878, February.)
 = *zelleriella*, Chamb. (nec. Clem.). Cin. Qr. Jr., Sc., II, 110. (1875.)
 = *bicolor*, Frey. Stett. Ent. Zeit. XXXIX, 255. (1878, September.)

Since I have had the type of *bicolor*, Frey, I am convinced that this is the species indicated by Chambers under the name *clemensella*, no other agreeing with his description of the hind wings. They are exactly as he writes [Bull. U. S. G. G. Surv., IV, 98 (1878)]. "The hind wings are also paler and wider; though not nearly so wide, and tapering much more gradually to the acute apex, than in *latipennella*, with which it otherwise agrees, except that it lacks the yellow tint along the apical part of the costa."

***Tischeria castanella*, Chamb.**

I am unacquainted with this species, but it seems to be distinguished by having the abdomen densely dusted beneath with brownish-yellow, a character which also occurs in *citrinipennella* and *clemensella*, it is nearly one-third of an inch in expanse. I should have been persuaded that Chambers's description referred to *sulphurea*, Frey, but I am unable to distinguish any brownish-yellow dusting beneath the abdomen of Frey's type. Chambers, unfortunately, omits to mention the hind wings in his description of *castanella*.

***Tischeria fuscomarginella*, Chamb.**

The specimens referred to *fuscomarginella* [INSECT LIFE, II, 324 (1890)] were wrongly identified. The Texan specimen is a ♀ of *citrinipennella*, while the Missouri specimens are at present undetermined, though they seem to agree approximately with Chambers's description. I have not yet seen an authentic specimen of *fuscomarginella*, Chamb.

***Tischeria tinctoriella*, Chamb.**

T. concolor, Z., *clemensella*, Chamb., and *tinctoriella*, Chamb., are distinguished from the other species of this genus by the dull ochreous color of the fore wings.

T. tinctoriella may be separated from *clemensella* by the normal shape of the hind wings, which are not widened at the base, and sharply attenuated from the middle as in the latter species; *tinctoriella* differs from *concolor* in possessing a patch of brownish-fuscous scales on the upper side of the fore wings at the anal angle. The larva feeds in a blotch mine on the upper side of the leaf, and is well described by Chambers as containing a circular nidus streaked with zigzag purple lines, whereas that of *concolor* strongly impresses the edge of the leaf. Its darker color at once distinguishes it from the pale *badiella*, although the group of gray scales is in the same position near the anal angle of the fore wings.

I hope that the corrections contained in these notes will make some amends for the too hasty publication of my previous impressions arrived at under difficulties which have been greatly removed by the acquisition of Frey's types. The only three described North American species now unrepresented in my cabinet are *castanella*, Chamb., *fuscomarginella*, Chamb. (under-side miner), and *pulvella*, Chamb.

The following tabulation of the oak-feeding species found in the United States may assist collectors to identify their captures by drawing their attention to the peculiarities by which most of them can be easily distinguished.

A. Hind wings of more than normal width.

B. Apical cilia of hind wings excised above in ♂, entire in ♀. = COPTOTRICHE, Wlsm.

1. Hind wings broad, abruptly depressed in both

sexes, gray or grayish = *Coptotriche zelleriella*, Clem.

- BB. Apical cilia not excised in ♂=TISCHERIA, Z.
1. Hind wings of ♂ broad, evenly lanceolate (♀ unknown).....= *Tischeria sulphurea*, Frey.
 2. Hind wings of both ♂ and ♀ widened at base, sharply attenuated from middle of wing.....= *Tischeria clemensella*, Chamb.
- AA. Hind wings of normal width.
- B. ♂ with distinct fuscous patch on under side near base of fore wings (not showing on upper side); a less conspicuous patch near base of hind wings (showing on both sides); ♀ without dark patches at base of wing= *Tischeria citrinipennella*, Clem.
- BB. ♂ without fuscous patches at bases of wings.
- C. With a distinct patch of fuscous scales on the upper side of fore wings at anal angle.
1. Fore wings pale lemon-yellow, apex reddish..= *Tischeria badiella*, Chamb.
 2. Fore wings dull ochreous.....= *Tischeria tinctoriella*, Chamb.
- CC. Without patch of fuscous scales on upper side of fore wings.
- D. Abdomen densely dusted beneath with brownish-yellow= *Tischeria castaneælla*, Chamb.
- DD. Abdomen not densely dusted beneath with brownish-yellow.
1. Fore wings dull ochreous.....= *Tischeria concolor* Z.
 2. Fore wings reddish-yellow, margined with purplish fuscous.....= *Tischeria fuscomarginella*, Chamb.

TISCHERIA, Z.

- | | |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------|
| 1. sulphurea, Frey (1878) | 7. fuscomarginella, Chamb. (1875) |
| 2. clemensella, Chamb. (1878—February)
= <i>zelleriella</i> , Chamb. (1875) (nec. Clem.)
= <i>bicolor</i> , Frey (1878—September) | 8. tinctoriella, Chamb. (1875) |
| 3. concolor, Z. (1875) | 9. helianthi, Frey (1878) |
| 4. castanella, Chamb. (1875) | 10. solidaginifoliella, Clem. (1859) |
| 5. citrinipennella, Clem. (1859) ♂
= <i>quercitella</i> , Clem. (1863) ♀
= <i>quercivorella</i> , Chamb. (1875) ♂ ♀ | 11. pruinosa, Chamb. (1875)
= <i>purinosa</i> , Chamb. (1875) |
| 6. badiella, Chamb. (1875)
= <i>bodicella</i> , Chamb. (1875)
= <i>citrinipennella</i> , Stn. Wlsm. (nec. Clem.)
= <i>sulphurea</i> , Wlsm. (1890) (nec. Frey) | 12. pulvella, Chamb. (1878) |
| | 13. heterotera, Frey (1878) |
| | 14. heliopsiella, Chamb. (1875)
= <i>nolckeni</i> , F. & B. (1876) |
| | 15. longeciliata, Frey (1878) |
| | 16. ambrosiella, Chamb. (1875) |
| | 17. ceanothi, Wlsm. (1890) |
| | 18. malifoliella, Clem. (1860) |
| | 19. ænea, F. & B. (1873) |
| | 20. roseticola, F. & B. (1873) |

DESCRIPTION OF CERTAIN LEPIDOPTEROUS LARVÆ.

By HARRISON G. DYAR, *Rhinebeck, N. Y.*

Pholisora hayhurstii, Edwards.

Larva.—Head as large as any part of the body, cordate, dull black, closely covered with short white hairs. Antennæ and mouth parts pale brownish. Joint 2 is very small, not more than half as high as the head; thence the body thickens to about joints 8 and 9, and then tapers somewhat to the posterior extremity. It is of about uniform width except joint 2, which is very narrow. There is a slight subventral fold. The upper half of joint 2 is covered by a pale brown cervical shield. Color dirty greenish yellow, with many small, pale-yellow spots, which segregate to form an obscure subdorsal line; a dark dorsal shade.

The larva inhabits an inclosure composed of part of a leaf folded over or of one or more leaves as it becomes larger.

Pupa.—Resembles in shape a pupa of *Eudamus*, and is held by a number of transverse threads in an inclosing leaf. The eyes are prominent, pilose. A brown elevated spot is situated above each, back of the antenna case. Color, dull yellow, covered by a white bloom. The cremaster is flat and hairy.

The food plant is *Alternanthera flavescens*.

Larvæ from Dade County, Florida.

***Triptogon imperator* Strecker.**

Mature larva.—Head rounded triangular, the clypeus laterally indented; green with many rather large whitish elevated spots, the front nearly all pale yellowish white, but with a purplish shade centrally at the sutures and the clypeus pale green. Mouth parts sordid white; maxillæ black inwardly. Cervical shield and anal plates colored like the sides of the head and furnished with whitish granulations, the lateral plates tinged with yellowish posteriorly. They do not quite meet the supraanal plate, leaving some of the skin of the body between. The color is green, with a purplish shade on the dorsum (indicating the approach of the change to pupa), and seven greenish white oblique lateral lines, interrupted between the segments, the first and sixth fainter than the others and sometimes almost obsolete. The last is broad and distinct and extends from above the base of the foot on joint 10 to the caudal horn, which is short and concolorous with it or tinged with purplish. In many the tip is black. The lines are not well defined at their edges, the outline being somewhat irregular and blended. Spiracles yellow-brown, the center white, but the ones on joint 2 are all white. Thoracic feet white, purplish at the tips, with fine brown hairs internally; abdominal feet green, purple outwardly above the claspers, then narrowly whitish and above this another slight purple shade. Venter centrally slightly and interruptedly paler. Each segment has about six transverse creases or annulets.

Length of larva, 80–90 millimetres; of horn, 3–4 millimetres; width of head, 7 millimetres; height, 8 millimetres; diameter of body, 15–17 millimetres.

These larvæ occurred to me abundantly in Phoenix, Arizona, in November, being drowned in the irrigating ditches in considerable numbers in their attempts to find a place for pupation after their descent from the cottonwood trees. Of some thirty taken from the water four revived sufficiently to pupate. Three produced female moths and the fourth a crop of *Tachina* flies.

***Orgyia definita* Packard.**

Mature larva.—Head pale yellow, shining, minutely mottled with grayish spots; labrum, antennæ, and a spot below the eyes white; ocelli and maxillæ black. Body pale yellow, a pale, almost colorless dorsal band, replaced on joint 2 by the pale yellow cervical shield, which is concolorous with the head and contains two yellow tubercles, widening on joints 5 to 8, and inclosing four square brush-like tufts of yellow hairs. It narrows again, inclosing the two retractile concolorous dorsal tubercles on joints 10 and 11, respectively. It is absent on joint 13. A narrow subdorsal and fainter stigmatal similarly colored lines. All these lines in different examples vary in color from nearly colorless through pale gray to blue gray, dark brown, or black. There is a velvety black spot between the dorsal tufts on joints 6 to 8. The usual warty tubercles of the body are arranged as in *Orgyia leucostigma*, and there is a pair of pencils of black plumed hairs on joint 2 and a single dorsal one on joint 12, which is mainly composed of light brown hairs. The warts bear a few thin long white hairs. Spiracles white in a narrow black border. Larvæ from Dutchess County, New York.

The three species of *Orgyia* that occur in New York can readily be distinguished by the way they deposit their eggs. *O. definita* covers them with hair from the body of the mother moth; *O. leucostigma* covers them with a white froth without hair, while *O. antiqua* (= *nova*) deposits them without any covering.

Apatela tritona Hübner.

Mature larva.—The head is of a purplish color, darker on the vertex, with a lateral line. The body is light yellowish green, with a purple brown dorsal stripe bordered with reddish yellow, interrupted on joint 6 and inclosing a reddish green patch on joints 8 to 11. The spiracles are black; the hairs long and black, few in number.

Food plants, species of *Vaccinium*. Larvæ from Ulster County, New York.

EXTRACTS FROM CORRESPONDENCE.**The Quicksilver Remedy for Phylloxera.**

The *Scientific American* paper, of this city, published the 10th of June, 1885, that Mr. John A. Bauer, of San Francisco, California, had found a sure and cheap preventive of the ravages of the "Phylloxera," which consisted in the application to the vine plant of a compound of half an ounce of quicksilver in very minute particles and an equal weight of pulverized clay. The quantity of the mixture had to be half an ounce for each plant. The journal added that the remedy was simple; that it could be prepared, assayed for several purposes, and applied without danger or technical skill.

I consequently wrote to my friends, Mr. John B. Pratt and Mr. Paul Griñan, of Barcelona (Spain), on the subject, and I invited them to give a trial to the important discovery of Mr. Bauer. Mr. Pratt wrote to me subsequently as follows:

"I have the regret to inform you that our friend, Dr. Griñan, has tried for one hundred times at least to prepare the anti-phylloxera compound discovered by Mr. Bauer in San Francisco. He (Mr. Griñan) has used all the means that science and experience advise, but to no avail, because he has not been able to obtain the assimilation of the mercury and the clay. There must therefore exist either an especial machine or an ingredient unknown so far to us for making the anti-phylloxera preparation, and we earnestly beg of you to inquire about the matter and inform us."

I consequently wrote to Mr. Bauer on the 3d of last March, but as yet have received no answer. A friend of mine, Mr. MacArdle, who knows you by your high reputation as the best judge in the phylloxera question, has advised me to take the liberty of consulting you on the matter, and it is for this reason that I come to beg of your extreme kindness the favor of informing me how can my friend in Barcelona succeed in making the compound invented by the above-mentioned Mr. Bauer. * * *—[Joseph de Susini, 103 West Fourteenth street, New York, N. Y., April 7, 1891.

REPLY.—I have your letter of the 7th of April, referring to Bauer's quicksilver remedy for grapevine phylloxera. This remedy was proposed in 1884 and attracted considerable attention at that time. So far as I am aware, Mr. Bauer has not published his method of mixing the earth and the mercury. In Bulletin No. 18 of the Agricultural Experiment Station of the University of California, published October 1, 1884, Prof. E. W. Hilgard, in treating of this remedy, says there can be no doubt as to the efficacy of metallic mercury finely diffused through the soil in killing phylloxera or any other small insect remaining within its reach for any length of time. In another paragraph of the same bulletin he makes use of this expression: "A soil column of 6 or 8 inches depth, impregnated with the mercurial vapor by intermixture with 'blue mass,' will effectually prevent, etc." In other words, the mixture is spoken of as a simple mechanical operation, and I was not hitherto aware that there was any difficulty with that phase of the application. I was not at all favorably impressed with the remedy at the start, and the experiments made later by Professor Hilgard and his assistants failed in a large majority of cases to produce the expected effect. Mr. Bauer's original idea was to place a small quantity of the mixture about the base of the vine, to prevent the underground forms from crawling up, the vapor

killing all individuals which attempted to do so. The obstacles to success are, in the first place, that by no means all of the lice crawl up the main roots, but issue from the ground from rootlets near the surface, and crawl away to other vines; and in the second place, that soils of differing characters have very different powers of absorbing the mercurial vapor, becoming impregnated to different degrees or not at all.

I regret that I can give you no more definite information as to the method of preparation, but in view of the comparative success of the latest French work with the American vine and bisulphide of carbon injected subterraneously, and in view of the discouraging results of Professor Hilgard's California experiments with Mr. Bauer's mixture, it seems to me that it would be hardly worth while for Dr. Grifan to spend any further time with this mercury preparation.—[April 15, 1891.]

Another Spider Bite.

I have been much interested in the reports of spider bites which have been published in INSECT LIFE. What is wanted in such cases is positive, indisputable knowledge, and to this end I will relate my experience regarding the biting ability of at least one species of spider. When in Virginia, about 10 years ago, I was one day standing by and looking out of a window. The sleeve and cuff were drawn up from my wrist, leaving it exposed. A small black spider with, I think, a tiny red spot upon its body, suspended itself from a web, and before I noticed it had alighted on my left wrist, just above the pulse. I made a quick movement to dislodge the spider, and felt a sharp pain, as if from the prick of a needle. There arose in a few moments a hard spot, with a dot of red in the center, as from a mosquito bite. The next day my wrist was swollen and the veins stood out prominently and black as far up as the elbow, while sharp pains extended to the shoulder. The flesh around the bite became purplish-black for a space of $2\frac{1}{2}$ by 2 inches. Remedies were applied, but the purplish flesh sloughed off until the sinews were plainly visible. My arm was carried in a sling for a week or more, and it was some months before the flesh had filled out and regained its normal condition. My recollection of the episode is very vivid, for I was considerably frightened at the time. I did not feel any sickness other than the throbbing pain, which was at times quite severe. Poultices and a tonic for the blood were the remedies used. I would be afraid to make an assertion regarding the identity of the spider at this late day, but have, of course, a right to my suspicion.—[Emory E. Smith, 1409 Van Ness street, San Francisco, California.]

The California Peach-tree Borer.

A short time ago I examined some nursery peach trees imported from Alabama and Missouri, and found in both lots several larvæ of *Sannina exitiosa*. More recently some peach trees grown in the northern part of the State were brought to me for examination, and I found in some of them what appeared to be the same kind of larvæ as the above, but I notice that in one of Mr. Klee's reports he refers to a native species he found infesting peach trees, and the larvæ I found may be the same as this. He quotes your letter to him of September 4, 1888, in which you propose to describe this Californian form under the name of *Sannina pacifica*, and that it connects through *S. exitiosa* with *S. Fitchii*. I notice that Henry Edwards regards *Fitchii* as being only a variety of *exitiosa*. Do you consider *pacifica* as being also a variety of *exitiosa*, and is it found elsewhere than in California? I would also be glad to know if the larvæ of these two forms can be separated by any constant characters; or if their manner of forming their burrows is different in the two forms.

The lower portion and roots of the tree first mentioned above were immersed for 2 minutes into a solution of 1 pound of whale-oil soap to the gallon of water, the temperature of the solution being maintained at from 120° to 130° F. I again examined these trees 5 days after the last one had been dipped, and all of the *Sannina* larvæ that I found were as lively and vigorous as ever. The dipping had been done

under the immediate supervision of Inspector Richardson, of Pasadena, whom I know to be a very careful and conscientious person, and the larvæ therefore did not escape being destroyed simply through the carelessness or indifference of those who dipped the trees. * * * [D. W. Coquillett, Los Angeles, California, January 7, 1891.]

REPLY.— * * * *Sannina pacifica* undoubtedly differs from *S. exitiosa* as follows:

The female of *pacifica* differs from that of *exitiosa* only in lacking the red band across the abdomen and in the absence of the black border along the last two veins of the hind wings; and the male only in its broader apical margin of the front wings and the presence of a short black dash a little in front of the middle of the anterior margin of the hind wings.

The differences in the pupa are quite marked. In the Californian species there are six double rows of teeth, two on each of segments 2-7, with a single row on the last two segments; while on that of *exitiosa* there are but five double rows of teeth, two on each of segments 2-6, and a single row on the last three.

The only perceptible though apparently quite constant difference in the larvæ is that in the Californian species the head is perfectly smooth, without any sculpturing, and uniform in coloration, whereas in *exitiosa* it is marked posteriorly with 4 or 5 oblique, darker brown stripes or spots each side, and is slightly reticulated or granulated.—[January 17, 1891.]

Some New Injurious Insects in Russia.

* * * I take this opportunity of sending you a few words on the newest observations on injurious insects in Russia.

During this summer I discovered near Moscow, on the buds of Black Currant, *Phytoptus ribis* Westw., and it appeared that this mite is quite injurious here, as it causes numerous shoots to die. I had occasion to visit several gardens where this pest had appeared in great numbers. Hitherto it had never been observed in Russia.

Another novelty for the Russian fauna is *Mytilapsis citricola* Pack., which was recently found by me in a hothouse near Moscow on lemon (*Citrus medica*), on the leaves as well as on the fruit. Of course this insect can with us never acquire such importance as it has in Florida, but the fact of its occurrence near Moscow is of great interest and seems to corroborate Professor Comstock's supposition, who asserted that the insect came to America from Europe. (See Report of the Entomologist, etc., for the year 1880 (1881), p. 323.)

Much damage has been done the past summer in the whole middle Russia by *Psylla mali* to Apple and Pear. In western Europe this insect appears to be less injurious than with us. In middle Russia I have seen orchards this summer which did not bear a single apple since the buds had been killed by the sucking of the larvæ of the *Psylla*.—[Prof. Dr. K. Lindeman, Moscow, Russia, December 1, 1889.]

Some Traits of the English Sparrow in England.

I read what you are so good as to send me with great pleasure at all times, but your last present of the "English Sparrow" delights me very much; your views are precisely mine. My friend James, who assisted Gurney in his book on the subject, thinks that the sparrow costs us as much as the total expense of the British army. I consider the sparrows to be more destructive than rats or mice, and I feel certain that, as the numbers increase and the struggle for existence becomes more severe, they will develop new destructive habits. I will illustrate what I mean: Our gardens in spring are adorned with the crocus, and in my younger days they were not injured by sparrows; but some 20 years ago they began to destroy the blooms of the yellow crocus only (*Crocus aureus*). The style of this species is short. For many years I noticed that the blue and white species (*Crocus vernus*) was unmolested, but for some time they have taken to destroying the flowers of this species. It has a long style, and is never yellow, but once having found out its edibility, they mar the

beauty of my garden by strewing the ground with the flowers of both species indiscriminately. Quite recently they have taken to eating off, close to the calyx, the flower of the common yellow primrose (*Primula vulgaris*), but at present I have seen none but yellow blooms so eaten, but I fear that they will soon find out that the darker-colored varieties are palatable, and then the deflorescence will extend. They destroy the buds of my gooseberry bushes to a most vexing extent, often reducing seriously the crop of this valuable fruit.

My currant bushes they seriously injure in another way; when the shoots are young and have aphids upon them they endeavor most clumsily to eat a few, and by their weight break the tender shoots down, so that they have to be removed. My pears suffer sad damage. I have some excellent varieties that must not be gathered too early, but the sparrows, as soon as the fruit begins to ripen, peck holes near the stalk and thus utterly spoil the pears for keeping and render them too unsightly for dessert, as well as injuring the flavor, if not rendering them flavorless.

I do not know, near my house, that a single swallow (*Hirundo urbica*) has bred this year. This valuable purely insectivorous bird is becoming rarer year by year, because the sparrows take possession of their nests and prevent their building.

The sparrow is a serious question. I know of no other British finch that breeds several times in the year and lays six eggs; five is the normal number of finches. I have even good reason to believe that a male sparrow has sometimes more than one mate. I watched carefully the nest of a female sparrow one year; she had no tail, and I never saw a bird with a tail near the nest. What a singular thing it is that *Passer domesticus* should be so destructive, and *Passer nocturnus* does not increase in a similar manner. The species can not be very remotely related, because my friend Edward Newman obtained hybrids between them in his aviary.

Our fight about the Colorado Potato Beetle has subsided, but I did *obtain it alive* in some American potatoes. I do not suffer much from the ravages of other insects or snails in my garden; the latter are rare with me; the cause is the abundance of thrushes and blackbirds. My greatest trouble is my greenhouse, where I have had great destruction caused by the *Aleurodes vaporariorum*, no doubt the same species you wrote about in reply to an inquiry in INSECT LIFE, in which you stated you did not know the name. My pest was named for me by Douglas, our best authority on the subject. * * * —[J. Jenner Weir, Chirbury, Beckenham, Kent, England, December 28, 1890.

Codling Moth in New Zealand.

I am now in all respects splendidly situated for studying the habits of the Codling Moth. Already I feel sure its life history wants rewriting in some respects. *Here*, at all events, it does not lay the egg on the blossom, nor yet, either invariably or even very often, in the eye of the apple. The egg is laid *anywhere*, and the little caterpillar seeks the shelter of the eye, but I am convinced that it does not do so immediately, but takes bites out of the skin here and there, and quite as often as not enters in other places. This would account for the comparative ease of poisoning with Paris Green. The caterpillars are leaving the apples now, and I have thousands under daily observation, and I mean to see whether any hymenopterous fly is at work, and also to collect some hundreds later on (at different times) *in the cocoons* to see if I can find any more of my dipterons. In the mean time, the "yellow hammers" (so called in England) are very numerous, but by the closest every day observation I fail to see a single instance of their attacking the Codling Moth larvæ. I do not know what to make of the strengths of Paris Green. Have burned foliage with 1 pound to 200 gallons of water (used in the heat of the day), and my Nelson friends laugh at me for advocating that strength and inform me that 1 ounce to 50 gallons of water is a *strong solution*, and even much weaker is used with such success, that their once very severely infested orchards are so far cured that they have ceased to grumble about the pest. I can rely upon these people's statements, but *here* they use 1 pound to 50 gallons of

water, and from that to 180, but no one anything weaker, and not with much success either. If my observations show anything, I will not fail to keep you informed.—[R. A. Wight, Paeroa, Auckland, New Zealand, February 2, 1891.]

Icerya and Vedalia in New Zealand and Australia.

I had not intended to ask you to send me any specimens of *Vedalia cardinalis*, but I have been so earnestly pressed to do so that I have yielded. *Icerya* has returned here to every place where it was before, and people seem to imagine that I have some means of providing them with these beetles. I could foresee what would happen, and I did what little I could to induce the government to take care of *Vedalia*, but I could get neither them nor the association to take the necessary steps. A few, and a few only, of the beetles should have been kept on hand, and a house of *Icerya* should have been preserved for their use. It is not necessary to keep a large number of *Vedalia* on hand; a very small number of them, even one or two pairs, turned out in a large infected orange grove will very soon overtake *Icerya*. I think from what you say in your last letter, that it is very probable that you may not be able to send me any *Vedalia*, but if you can send only three or four of them, and direct the little parcel to Dr. Locking, President of the Fruit Growers' Association, Nelson, New Zealand, I would be very much obliged to you, and I feel ashamed to ask, as I have not been able to do as you desired in the same way for the Cape of Good Hope. Our Government desired some of their officials at Napier (where Mr. Koebele got 6,000 in three days in 1888) to collect and transmit to an infected district some of the *Vedalia*, but these gentlemen made a very natural mistake, and sent another Coccinellid somewhat like it.

I at once sent technical colored drawings of the two species, and offered to identify any specimens sent, in the hope that they might be procured, in which case I would have gone there and procured supplies, both for our own people and the Cape. I am anxious the Cape government should have them, because I think they would profit by Californian and United States experience, and not let the supply run out, and then we could all look to Africa for future supplies, for you may rest assured that *Icerya* will return to California, and probably the beetle may be no further to be had then than it is now with us. *Icerya is sure to return*. Mr. Olliff, the New South Wales government entomologist, wrote to me the other day very anxious to procure specimens, dead or alive, "if only one," as he is working up Australian Coccinellids, but I had not a single specimen, having given my last away long ago. He says the only specimen in all Australia is in the British Museum, and no one there ever saw the insect, but Mulsant described it in 1847 as a very rare Australian insect, and I feel quite certain, for many good reasons, that it was brought here with *Icerya* from Australia. I am afraid we will not find it here now, as this is the month which it should be in force, and also in March, but I do not quite give it up till the end of March.

What puzzles Mr. Olliff is that he can not find "a trace of it" in any of the bunches of *Icerya* he has searched, but I tell him that if *Vedalia* were there there would be no "bunches" to search, and what always puzzled me in Mr. Koebele's account of his trip, was that he should find *Vedalia* in small numbers and also *Icerya* perforated by *Lestophonus*, because I never found *Vedalia* except in large numbers, and wherever they appeared *Icerya* for the time being completely vanished. I never knew any half measures, or any moderation in *Vedalia*. It was always a vast crowd, or none at all.—[R. Allan Wight, Paeroa, Auckland, New Zealand, February 2, 1891.]

The Rhinoceros Beetle in a Woodshed.

I send you by mail rare specimens of bugs I unearthed in cleaning out my wood-house today, which has not been cleaned out for 25 years. I have shown them to hundreds of persons, and they all say they never saw any bug like them. They were

dug up 18 or 20 inches below the surface. I think they are a species of "beetle," but no one here can classify them. I am anxious to know what they really are. They are all alive and doing well at this writing. Please let me hear from you. If there is any pay would be glad to get it. The nest or lodging place sent you will show how the bugs winter and feed. The one without nippers I think is female, the others males.—[John M. Leavell, Culpeper, Virginia, March 11, 1891.]

REPLY.—* * * The beetle which you send is the Rhinoceros Beetle (*Dynastes titus*), which breeds in dead and decaying wood. * * *—[March, 1891.]

A Codling Moth Larva in March.

I venture to obtrude on your attention what I believe to be a curious find. Of the facts as I recite them I am positive of the smallest detail. While eating an apple this afternoon I bit out a large piece and laid bare a dark worm in the usual groove. I removed the piece and cut out the upper part of his groove which came away with the bite. Noticing that it left a clean, sound surface I looked for a moment expecting Mr. Worm to make tracks toward the core, but he did not move. I then took my knife and cut out his groove and him with it, cleaning out each end of the groove expecting to find a hole to the core, as usual, but was astonished to encounter clean, solid apple at each end of his recess with something of a resemblance to a hard scar at the blossom end of his groove. The ends of his groove both projected into the apple as first laid open, for it was nearly on a plane with the meridian and parallel to the surface of the apple. I send the worm, with a portion of the groove, under separate cover. I noticed at first several coarse white filaments similar to gray hairs, and I wondered if it were possible for an egg to have been deposited in the solid meat of the apple instead of in the core by a misdirected thrust of an ovipositor and the wound to have healed up, hence the scar in the solid meat, the egg to hatch in it, the worm to die before getting to the open air.—[E. D. Wileman, Secretary and Treasurer of Ohio Society of Surveyors and Civil Engineers, Massillon, Ohio, March 11, 1891.]

REPLY.—The "worm" is evidently a two-thirds grown Codling Moth larva, and its presence on the apple in this condition, at this season of the year, is unusual though not unprecedented. It is a larva from the second brood of moths, and so great is the irregularity in the time of appearance of the second brood that eggs are frequently laid as late as September or the first of October. The larvæ naturally develop much more slowly in cold weather than in warm, and consequently many are very small when winter apples are picked in the late fall. The eggs of the second brood are often laid upon the side of the apple instead of upon the flower, and the larvæ penetrate the flesh immediately after hatching and are then so small that the opening which they leave is not noticeable, and in fact is usually completely closed by the subsequent growth of the apple. The white filaments "similar to grey hairs" were probably threads of silk spun by the larva. There is, then, nothing very unusual in this observation, but your account of it is interesting and the late finding of the larva is worthy of record.—[March 26, 1891.]

Dipterous Larvæ Vomited by a Child.

I send by mail to-day a specimen of some kind of larva of Diptera, as I suppose. These with hundreds of others were vomited by a child of 18 months of age, last December. There is no doubt of their origin as they were thrown up while the physician was in the room. The *Annual of Universal Medical Sciences*, 1890, Vol. I, p. 23, is the only literature on the subject I have found.

I sent these specimens to Professor Leidy, of Philadelphia, who writes me that they are undoubtedly larvæ of some Diptera, but is unable to identify the species and refers me to you.

I had a beautiful glycerine specimen, but a friend has smashed it in examination. I hope the balsam specimen will be sufficient to enable you to identify the species.

If it should prove to be such a case it will be, I think, the first one reported in this country.—[F. W. Higgins, M. D., Nos. 8 and 9 Wallace Building, Cortland, New York, March 14, 1891.]

REPLY.—* * * These specimens are of great interest, although they are not sufficiently advanced to enable us to determine the species with certainty. In fact this can only be done by rearing the adult fly. A careful examination, however, leads me to believe that they belong to the genus *Sarcophaga*, or, at all events, to some closely allied genus of the family Sarcophagidae. These insects are ordinarily called Flesh Flies. There is a European species known as *Sarcophaga wohlfarti*, which has been known to occur in a similar way in Russia, while species of the closely allied genus *Sarcophila* have been known to infest the ears, nose, and wounds of man and other animals.

You will find a general summary of the subject of Myiasis or pseudo-parasitism of the Diptera in man, in a paper by Hugo Summa, A. M., M. D., in the April, May, and June, 1889, numbers of the *St. Louis Medical and Surgical Journal*. The April number sums up the hitherto recorded cases with which the author was familiar; article 2 contains the classification of these cases and additional records, with an account of two recent cases of nasal parasitism, and the June number contains the clinical history of the trouble. Nearly all the cases in which *Sarcophaga* is concerned have been parasitism of the nose or ears, or of wounds, while intestinal parasitism is in general due to the larvæ of flies of other families, principally Anthomyiidae, which have presumably entered the patient with spoiled vegetables, eaten raw, as in salads. The fact that your patient was a child of 18 months probably precluded the possibility of this method of entrance, and a more plausible explanation would seem to be that the female fly deposited her living larvæ in the mouth of the child while it was sleeping. Further facts with which we are not familiar may, however, contradict the possibility of this method.—[March 18, 1891.]

Economic Value of the Study of Insects.

Can you help me to any literature or to references to any literature where I can find or work up some terse statements of the value to the community of, for instance, the study of the life history of parasites of animals and vegetable life; the saving in dollars and cents (the most forceful showing to the average man) of crops and herds by or through such investigations. I have heard business men of good intelligence make sharp criticism of the Government for making appropriations of money for your Commission. I have met this by the bald statement that it had paid for itself many thousand fold in the discovery and promulgation of means and methods of saving crops of enormous value from destruction by parasites or other enemies.

What I want is authenticated facts and figures to back up my statement.—[Dan. Humphrey, M. D., Lawrence, Massachusetts, February 26, 1891.]

REPLY.—* * * The only facts that can be given relate to the destruction occasioned by insect attacks. No very recent estimates of the loss arising from insect ravages have been made, but some of the older estimates are here given. Twenty-five years ago B. D. Walsh, the entomologist of Illinois, estimated the loss from this source at from \$200,000,000 to \$300,000,000 per annum. The great increase in acreage of crops and orchards since that date has been attended, of course, with a corresponding increase in destructiveness; but methods of prevention and remedies have so multiplied and improved that the ratio of loss has greatly decreased. Fitch, then New York State entomologist, estimated the damage to the wheat crop of that State in the year 1854 by the Wheat-midge at \$15,000,000. The loss to wheat and corn on account of the ravages of the Chinch Bug in the State of Illinois alone in 1867 was estimated at \$73,000,000. The loss occasioned in 1874 to corn, vegetables, and other crops by the Rocky Mountain Locust in the States of Kansas, Nebraska, Iowa, and Missouri were estimated by Riley, from carefully collected data, at \$100,000,000, to say nothing of the indirect loss by stoppage of business and other enterprises, which would probably increase the total loss to the neighborhood of about \$200,000,000.

The ravages in the principal cotton States of the Cotton Worm have amounted to a loss of about \$30,000,000 in years of great abundance, while for many years the average annual loss was not less than 15 millions. A more recent estimate than those given may be mentioned.

The damage occasioned by the Chinch Bug in the year 1887 was estimated in the Annual Report of this Department for that year at not less than \$60,000,000. I have, in fact, repeatedly published the general estimate that the average annual loss to the United States from injurious insects exceeds \$300,000,000.

The investigations of the U. S. Entomological Commission and of the Division of Entomology, Department of Agriculture, and also of State Experiment Station Entomologists and private workers, have led to the discovery of remedies and preventives which, if properly and thoroughly applied, result in saving a large percentage of the loss occasioned by insects, and your statement that these investigations have paid for themselves many thousand fold is indubitably true.—[March 2, 1891.]

The Long Scale and the Wax Scale.

You will confer a great favor if you will kindly inform me of the nature of the parasites on the inclosed slips of orange (No. 1 infests the whole plantation of young trees planted this spring; No. 2 is the only sample so far found). Also the remedies to be applied as well as what means can be taken to prevent the spread to other trees. * * * —[H. Fitz Hart, Avory Post-office, Louisiana, March 14, 1891.]

REPLY.—* * * The scale-insects you send are the following: (1) Long Scale (*Mytilaspis gloveri*); (2) Wax Scale (*Ceroplastes floridensis*). This is the first time the latter insect has been reported from Louisiana. It is not a dangerous pest in Florida, and occurs mainly upon the wild plant known as the Gall Berry (*Ilex glabra*). Occasionally, however, it is found upon citrus trees, but never in sufficient numbers to be known as a pest. The Long Scale, however, is quite a serious enemy to the orange and lemon in different parts of the world. The best remedy will be found in the free use of a dilute kerosene soap emulsion, made according to the formula, a copy of which is inclosed on a separate sheet, and this should preferably be applied in your locality in the month of April, when the young lice are hatching and migrating from the parent scales.—[March 19, 1891.]

Ducks and the Colorado Potato-beetle.

I notice in Vol. III of INSECT LIFE, "Bird Enemies of Potato-beetle." I wish to add my experience in that line. Several seasons ago my potato field was almost ruined because I could not use Paris green, as my stock was in danger from it. A large pond of water attracted about twenty of my neighbor's ducks to its shore. I never did fancy ducks very much, and I told him so. He said he would give them to me if I could care for them, as he could not keep them at home. The next morning I went down to the pond at sunrise to try and drive said ducks in a pen. I saw a very curious sight. Headed by an old drake, the twenty ducks were waddling off in a bee line for my potato field. I crawled into some bushes and awaited developments. As they came to the end of the rows they seemed to deploy right and left, and such a shoveling in of bugs I never beheld. They meant business, and for fully one-half hour did they continue, until every duck was filled up to its bill with bugs. Then they went for that pond and I went for their owner and paid him \$1 for the entire bunch—this being all he would accept. When I returned, every duck seemed to be trying to outdo its fellow in noise. This expedition was repeated about 4 p. m. and kept up until every bug went under. I have tried these ducks and others since and find they all like them and seem to get fat on Potato bugs. I have been an ardent sportsman all my life and never saw quail eat the bugs in this western country.—[E. H. Kern, Mankato, Kansas, February 17, 1891.]

REPLY.—* * * Your note concerning the ducks and the potato bugs is very interesting, although quite in line with some observations of my own which I have published in my book on Potato Pests, and elsewhere. * * *—[February 24, 1891.]

Damage to Geranium by *Heliothis*; Cannibalistic Habit of this Larva.

I send to your address to-day a box containing moth of a corn worm. Last fall I noticed that something was eating the leaves of the Geraniums in the greenhouse; on examination I found it to be a pale green worm about two-thirds the size of the corn worm, which I was unable to determine positively. I placed a geranium in a cage with the worm and changed the plant as often as the leaves became soiled or scarce; the worm devoured the leaves rapidly. I also placed a cabbage worm (*Pieris protodice*) on the plant with it; on examining the plant next day, I found the corn worm was eating the cabbage worm and had already nearly devoured it when I first noticed it, and in a short time nothing was left of it but the head and a little of the skin. The moth sent is from the corn worm mentioned in this letter. The fact that this worm worked on geraniums, or that it was cannibalistic in its habits was new to me, and as I can find no notice of either, I write this and send the moth to you.—[John W. Clark, Missouri Agricultural College and Experiment Station, Columbia, Missouri, February 19, 1891.]

REPLY.—You are right in supposing that the moth which you send is the adult of the common Corn Ear worm (*Heliothis armigera*). Your letter is interesting, but both of the points which you notice have been observed before. If you will consult the article upon the Boll Worm (the same species) in the Fourth Report of the U. S. Entomological Commission, you will find the cannibalistic habit mentioned upon pages 364 and 365, while upon page 363 you will find the geranium mentioned as a food plant.—[February 24, 1891.]

A "Curious Condensation."

Clipping attached is from column of "Curious Condensations" in *Pittsburgh (Pa.) Gazette*. Can such things be?—[J. M. Shaffer, Keokuk, Iowa. February 20, 1891.]

"One of the most curious natural productions of the West Indies is the famed vegetable fly, an insect about the size and color of a drone bee, but without wings. In the month of May it buries itself in the earth and begins to vegetate. By the beginning of June a sprout has issued from the creature's back and made its appearance above the surface of the ground. By the end of July the tiny tree (known on the island as the fly-tree) has attained its full size, being then about 3 inches high, but a perfect tree in every particular, much resembling a delicate coral branch. Pods appear on its branches as soon as it arrives at its full growth; these ripen and drop off in August. Instead of containing seeds, as one would naturally suppose, these pods have from three to six small, hard worms upon the interior."

REPLY.—* * * The newspaper story is a romance with a grain of truth. You are familiar with the white grub fungus, are you not? It is a *Cordyceps*, which grows from the head or thorax of the white grub, and its shoots sometimes reach a length of several inches. The same phenomenon in the West Indies is the foundation for this story. It is quite within the bounds of possibility that the fungus may subsequently become infested by the larvæ of some fungus-feeding insect, as some Mordellid or Mycetophagid beetle or some Mycetophilid fly, and this may account for the "pods" containing worms instead of seeds.—[February 24, 1891.]

The "Mexican Jumping Bean."

I recently had a curious *bean* shown to me by a friend, and, desiring to learn more about this most interesting article, I take the liberty of addressing you on the subject, and will thank you kindly for any information you can give me regarding it.

The bean in question came from Mexico, is brown in color, and a section through it at right angles to its length would be a triangle. My friend said the name he had heard for it was "Broncho Bean," given from the fact that it had the power of locomotion, by means of quick, short jumps or tumbles, imparted to it, as I have since

learned, by a worm, which claims the bean as its home. The muscular effort exerted by the worm on the interior of the bean is sufficient to propel it forward about 3-16 inch at each jump. To a person who has not heard the reason for the peculiar action of the bean the movement is, to say the least, wonderful.

If there is a printed description of this bean, giving the localities in which it may be found, will you kindly advise me of same and much oblige * * * [W. H. Savery, Wilmington, Delaware, February 21, 1891.]

REPLY.— * * * It is the seed of a Euphorbiaceous plant believed to be *Colliquaja odorifera* Moline, and the contained "worm" is the larva of a little Tortricid moth known as *Carpocapsa saltitans*, a near relative of the common Codling Moth (*Carpocapsa pomonella*). It is found chiefly in Sonora, Mexico. I inclose for your information a copy of a short paper which I published upon this insect several years ago.—[February 24, 1891.]

The use of Paris Green in England.

Our special move onwards now is, I think, establishing steadily and gradually the use of Paris Green. Of course there was tremendous opposition, but when a man who has sprayed his trees has a glorious crop (and an excellent price for them), his neighbor who has none gets a good lesson.

I am bringing out a short paper, which will, I hope, make the method of application quite clear to the humblest capacity. There was a deal of trouble for want of spraying machines, but this I hope we have quite got over.—[E. A. Ormerod, St. Albans, England.]

Spraying for the Codling Moth in Oregon.

In compliance with your request I will make you a short report in regard to my experience in spraying for the Codling Moth, Green Aphis, and the Woolly Aphis (*Schizoneura lanigera*). I commenced spraying in February, using 1 pound B. T. Babbitt's lye to 5 gallons of water. This strength is all I dared to use on account of the swollen buds. It was strong enough, though, to kill all moss and living insects, though not strong enough to destroy the eggs of the Green Aphis. It should be as strong again for this purpose, and applied in December and January, when the trees are entirely dormant. The spraying for the Codling Moth was done when the fruit was fully formed and about the size of peas. The mixture used was 1 pound London purple dissolved in 160 gallons of water. The purple was put on during the middle of the day, when the sun was shining, and in 2 hours' time the trees were entirely dry. The second spraying was done 3 weeks later, and was put on as before. The effect of those two sprayings was to keep the worms out of the fruit until the latter part of July. Then another lot of eggs was laid, and at picking time some of the apples had worms just buried under the skin, while others had nearly reached the core. One peculiarity in my orchard was that there were very few apples where the worm had entered the calyx of the fruit, but most of them had entered from the side of the apple. I am satisfied that if I had sprayed every 3 weeks until the last of September I could have saved 98 per cent. of my apples. Pears were entirely free from worms this year that were badly infested last year. My orchard is badly infested with the Green Aphis and Woolly Aphis. But I think I can get them under control next year by using the kerosene emulsions. This seems to have better effect if sprayed on during a hot day, when it dries quickly and adheres to the trees and leaves. I also believe it will destroy the Woolly Aphis on the roots of the tree by letting it saturate the ground around the roots. I will experiment more thoroughly next season and send you the result of my labors. Taking it all in all, I feel fully satisfied that these insect pests can be held in subjection, if not entirely exterminated, by the use of the force pump, and next summer I intend to do the work thoroughly and systematically and make you a more complete report of the result, with the costs and net profits accruing from the same.—[E. P. Smith, Gresham, Oregon, December 8, 1890, to the Division of Pomology.]

A Case of Stomach Bots in Hogs.

IN INSECT LIFE No. 4, pp. 161 162. (1890) I see a note about Bot-flies infesting hogs. I have a bit of information in the same line that may interest you, although it is somewhat meager.

About a month ago a Mr. Fielder, of this town, butchered two hogs for his own supply of meat. They were apparently healthy and all well. In sticking one of them he noticed the blood was unusually dark colored, and the hog had unusual tenacity of life. When the intestines were removed the stomach was found to be infested with a "bot worm, just as horses are." The stomach also had some dry substance in it resembling half-chewed cornstalks. The worms had not yet eaten *through* the coatings of the stomach, although some were nearly through. Mr. Fielder took a large piece of the stomach with the worms attached and kept it for several days. It began to smell bad, and he threw it away. After it had been thrown away I learned of the case. It was something new to me, and I thought to give you an account of it, but neglected to do so. Had I learned of the case soon enough I should have secured the specimen and sent it to you in alcohol. If the case is of interest to you and you wish further information, I will learn from Mr. Fielder whatever I can and report to you.—[A. W. Moon, Principal Public School, Port Republic, New Jersey, December 13, 1890.]

REPLY.—Your note is very interesting, and I shall be glad to have you investigate the matter a little further. The item in INSECT LIFE which you mention refers not to a stomach bot, but to a grub which ordinarily infests the heads of wild animals, principally deer. Your case is interesting, because, if the information is correct, it will be the only case, so far as I know, in which the true stomach bot has been found in the hog. Hitherto the forms have been found only in the horse, the ass, and the rhinoceros. Inasmuch as no specimens were saved, you can oblige me by getting Mr. Fielder to give you as careful a description of the maggots as possible; and I should like also to have your opinion as to Mr. Fielder's reliability as an observer. He undoubtedly found something, but the question is, were these objects true botfly larvæ, or were they stomach worms or intestinal worms of some sort. I am very sorry that specimens were not preserved, as Mr. Fielder's recollection in any event will not be accepted by entomologists as final evidence.—[December 16, 1890.]

Case of a Child swallowing and passing Grubs infesting Chestnuts.

A lady living in Providence, Rhode Island, brought me a white worm with an amber-yellow head, preserved in alcohol, which she said had been passed by her little girl, 11 years of age. It appears that the child had been sick with some bronchial or similar trouble for about 6 weeks, and the physician had been somewhat perplexed about the case. On the evening of the 13th of October the child grew worse, with a feeling of oppression in the chest and sensations of a creeping nature, accompanied by coughing and vomiting. Suspecting that the trouble might be due to Ascarids, a vermifuge (Spigelia and Senna) was administered, and on the morning of the 14th two of the worms were discharged, being found buried in the feces.

One of the worms, the one best preserved, was submitted to me and I told the mother that it was probably the acorn or chestnut worm, and asked her if the patient had not eaten some acorns or chestnuts, but she said that the child had not eaten either. On further examination I felt sure the larva was that of a *Balaninus*. The next day I met the father and also the physician, when the father told me that the child had on the evening of the 17th eaten four boiled chestnuts, and that two of the worms had been found in the patient's stools.

The parents had been worried about the child and hoped they had found and removed the cause of the trouble, but on seeing the physician about three weeks later I learned that the child was still unwell, the trouble (partly a nervous one) not hav-

ing been either aggravated by the presence of the worms or alleviated by their removal.

The case is reported merely to show that probably many larvæ, especially those of flies and weevils, and other grubs living in seeds and fruits, may be swallowed and passed through the alimentary canal, without harm and with little or no annoyance to the person swallowing them; such cases rarely being brought to the notice of the physician.—[Dr. A. S. Packard, Providence, Rhode Island, October, 1890.]

Fertilization of Red Clover by Bumble Bees.

I saw this question asked through the *Inter Ocean* of Chicago: "Why does not the first crop of the small or medium clover produce seed?" The answer: "Because the Bumble Bee (Humble Bee) is not out in time to fertilize the blossoms." Does the Bumble Bee have any influence on the production of seed in the clover?—[H. R. Clark, Columbus, Columbia County, Wisconsin, November 8, 1890.]

REPLY.—It has been conclusively established that red clover (*Trifolium pratense* L.) will not mature its seeds without the cross fertilization brought about by the visits of insects, and particularly bumble bees, *Bombus* spp. Many other bees and also Lepidoptera (butterflies, moths, etc.), Diptera (two-winged flies), and beetles visit the clover blossoms, but these effect cross-fertilization to but a limited extent—the mouth parts of the bumble bee being especially fitted to this rôle. The smaller percentage of seeds in the first crop of clover is therefore due to the fact that the bees necessary to the production of perfect seeds are in the early spring and summer comparatively few in number. A number of experiments have been tried in England to establish the relation of the bee to clover, and similar experiments have also been made in this country, all going to show the dependence of the clover on the bee for full productiveness. A notable instance of the usefulness of the bumble bee in this regard is seen in the fact that when clover was first introduced into New Zealand it failed to produce seed, but later, when the bumble bees were introduced and became numerous, the clover matured perfect seeds.—[November 17, 1890.]

Sow Bugs Feeding on Living Plants.

In No. 3 of INSECT LIFE I see a notice on page 69 about the Sow Bug, and a doubt is editorially expressed as to whether it feeds on living plants. I send you herewith a Cactus (*Mammillaria phellosperma*) which I have had potted for 2 years on account of its unusual form. This preceding spring and summer I was away from home for some months, and to keep the plant alive during my absence I planted the pot deep into the ground in a damp place, and while so planted the grass somewhat overran the pot and plant, forming a shady retreat for the sow bugs, which ate into the cactus so badly that when I saw it was ruined I threw it away. The Cactus did not decay either before or after being attacked by the sow bugs, but the flesh was raw, yet quite fresh and healthy, and began to grow again after I had routed the bugs. The Cactus has now been out of soil for 2 or 3 weeks, yet will probably live if it be planted again.

Further: Three weeks ago I received some plants by mail from New York—some roses, Geraniums, and a Wistaria. Upon the arrival of the plants I could not at once attend to them, and so I heeled them in damp soil and covered them pretty closely over with some old carpet. They remained there some days, and when I took them up to plant them they were swarming with sow bugs, and I soon found that the Wistaria had apparently been making a start at many of the buds, but all had been eaten off so deeply and persistently that the vine is apparently killed, having made no growth since. The buds, or places where the buds should have been, were freshly eaten, as I carefully noted. I think that some of the other plants were injured also, but gave the matter no very careful investigation, as none were of so much value or

interest as the Wistaria. The sow bugs feed at night chiefly. This country is infested with many species of them.—[W. G. Wright, San Bernardino, California, November 1, 1890.]

Nezara again Injuring Plants.

A neighbor has handed me a number of bugs which have been doing much mischief in this section. Besides preying upon the products of the garden, they are devouring the cotton plants in the field. I have been familiar with this insect for years, but it has heretofore done but little mischief.—[Robert Gamble, Tallahassee, Florida, November 14, 1890.]

REPLY.—This is the so-called Green Soldier Bug (*Nezara hiliaris*). This insect was mentioned in the Fourth Report of the U. S. Entomological Commission, page 79, as having been actually observed to prey on the cotton caterpillar, and in Hubbard's Report on Insects Affecting the Orange it is said that it has sometimes been observed to suck the tender shoots of the orange, causing them to wither and die. It is then, apparently, both carnivorous and a plant feeder, and if your account is founded upon definite observations, it is quite probable that the harm done with you overbalances the good. If this is so, it will be necessary for you to apply some remedy. In this case you could do no better than to spray garden vegetables while the bugs are on them with a dilute kerosene emulsion made according to a formula copy of which is inclosed on a separate sheet.—[November 19, 1890.]

ANOTHER LETTER.—I have sent by this mail, in a box, some specimens of insects which seem to be *Raphigaster pennsylvanicus*. They were sent me by a man who reported them destroying peafields at the rate of half an acre per day. I cannot find any account of this insect attacking such plants. This pest, being a sucker, can not be poisoned with arsenic, and seems rather difficult to deal with. Do you know anything better than hand-picking?—[Gerald McCarthy, Agricultural Experiment Station, Raleigh, North Carolina, September 5, 1890.]

REPLY.—The bug which you send is *Nezara hiliaris* Say. It is exceedingly closely allied to *N. pennsylvanica*, and I do not wonder at your mistaking it for the latter. These bugs seem to be both phytophagous and carnivorous, and I do not doubt your statement that this one attacks peas, although you will find it mentioned in the Fourth Report of the U. S. Entomological Commission as one of the Heteroptera which prey upon the Cotton Worm. We apply to all these sucking insects an emulsion of kerosene and soap, varying in strength according to the crop upon which the insects are feeding. Susceptible plants, such as the Peach, should be sprayed with one part of our standard emulsion to 15 parts of water, but the orange and other less susceptible plants will stand one part to ten.—[September 11, 1890.]

Mosquitoes in Boreal Latitudes.

Vol. I, No. 2, page 52, INSECT LIFE, contains an article on the "Hibernation of the Mosquito," and reminds me of a trip on snow-shoes from Mackinaw to the Sault de Ste. Marie in March, 1844. One noon we were delayed by the melting of the snow, which was from 2 to 4 feet deep, on a hillside, the sun coming out good and strong. The mosquitoes appeared by thousands, and annoyed us and our train dogs that pulled the mail on toboggans, so that we really had to make fight against them until nearly sundown. I have told this story before, but only got a laugh in reply. I hope with you I will meet with better success.

The Arctic region is the home of the real gray-back biting mosquitoes, and some of my friends who have wintered there inform me that they make their appearance on man about as soon as the sun peeps above the past winter horizon.—[Dr. E. Sterling, Cleveland, Ohio, November 14, 1890.]

REPLY.—Mosquitoes are known to occur in enormous numbers in the Arctic regions, and accounts of the excessive annoyance occasioned both to human beings and to animals in northern regions have been not infrequently given. The adults

are known also to winter over, but in limited numbers, and hence your observation of their occurrence in such excessive numbers in March is quite interesting.—[November 17, 1890.]

The Mealy Bug.

Is there any reliable remedy for the pest known as the Mealy Bug in the green-houses? All applications seem to be nearly *worthless* except hand-picking. We have tried all the advertised mixtures and are disgusted. How will the gas from cyanide potassium and sulphuric acid work in them, and can it be safely used by letting it have possession of the house over night and thoroughly ventilating the house the next morning? Would it be dangerous for the gardener to go into the house to ventilate it the next morning? I am fully aware of the deadly effect. I have used the cyanide jar to kill my specimens for the past three years.—[H. L. Jeffrey, Woodbury, Connecticut, November 21, 1890.]

REPLY.—Hydrocyanic acid gas, produced in the way which you mention, is being extensively used on the Pacific coast as a remedy against scale insects. Entire orange trees are covered with tents, and the acid is manufactured under the tent. I am not aware, however, that it has been tried in greenhouses on the scale which you suggest, but am inclined to think that there would be some danger in its use in this manner. A copy of bulletin 22 of this division is sent you by accompanying mail, and you will be able to see from the report of Mr. D. W. Coquillett the methods in use in California. From this account you will be able to get some idea as to rigging up a small apparatus for the disinfection of a few of your hothouse plants at a time. In case you attempt anything of the sort it will give us pleasure to learn the result.—[November 21, 1890.]

The Sweet-potato Root-borer.

Please find inclosed a few insects (alive just now) with small piece of sweet-potato (yam variety), in regard to which I would be pleased to have your opinion. They seem to be quite a pest to the potato crop in this section of Louisiana, certainly very destructive to the tubers.—[J. Ed. Blanchard, Thibodeaux, Louisiana, November 16, 1890.]

REPLY.—The insect which you send is the so-called Sweet-potato Root-borer (*Cylas formicarius*). It is a very destructive enemy to sweet-potatoes in regions where it occurs abundantly, but fortunately it is rare in most localities. The only remedy which has been suggested is to dig the potatoes as soon as they are found to be infested and to burn those containing insects or feed them to cattle, thus reducing the number and making the chances better for the next crop. You will find some account of this insect in the Annual Report of this Department for 1879, pages 249-250.—[November 19, 1890.]

Parasites of the Apple-tree Saperda.

In response to your request for my experience in regard to insect injury or habits, I will mention that I have this fall, for the first time, noticed that the Round-headed Apple-tree borer (*Saperda candida* Fabr.) had been parasitized, the larva being destroyed before it had done any damage to speak of. As Saunders, in his "Insects Injurious to Fruits," does not speak of any parasites of this species, and thinking it perhaps might be something new, I will endeavor to obtain some specimens for you the coming season if you deem it sufficiently interesting to investigate.

This borer is the greatest pest we have in our apple orchards here as it works from the base to the top. I have secured the beetle from sections of limbs but little over an inch in diameter. The period of its greatest activity seems to be the latter part of August and the whole of September, and the month of October is the best time for their removal, as they have not many of them eaten through the bark yet. There is no prospect of ever diminishing their numbers by any artificial means, as they come

in from the surrounding forests as fast as they are destroyed. I have taken as high as 17 borers from the base of one tree at one time. The alkaline wash is a good protection, but it can not be applied to all of the small limbs of the large trees. It seems as though the only relief must be through some parasite attacking it in its native haunts.—[James B. Smith, Highlands, North Carolina, November 17, 1890.]

REPLY.—Professor Riley has bred one or more parasites from the Round-headed Apple-borer, and only recently we received a parasite of this species from California. I trust, however, that you will be able to secure specimens of the species which is engaged in the good work in your vicinity and forward them to us for determination. I should think it worth your while to apply the soap-soda wash in order to keep the borers from the trunk and larger branches of your trees.—[November 21, 1890.]

Museum Pests.

In accordance with your request I send you by this mail a few specimens of *Anthrenus scrophulariæ* and *A. musæorum* as labeled in my collection. If I am "twisted" in regard to nomenclature please inform me. Should be pleased to hear from you in any case. The specimens of *A. musæorum* were all found in a neglected stock of duplicate specimens. I have never observed any on plants. Of *A. scrophulariæ*, some were found on flowers, some on carpets, and a few in above mentioned duplicates. I neglected to keep them separate, so can not state which particular specimens came from my collections. Those in my collection were all found just as they had become imagos. I think that I have succeeded in entirely destroying the pests, but if I find any more I will let you know immediately.—[E. E. Fernald, Melrose, Massachusetts, November 18, 1890.]

REPLY.—The insect which you have been considering as *Anthrenus musæorum* is *A. varius*, a common pest in such locations. The other species was *A. scrophulariæ* as you supposed. If the latter was found in your insect boxes as you state the note is interesting.—[November 21, 1890.]

Passalus for Ear-ache: Gall Insects.

By to-day's mail I send you some "Best" or "Bess Bugs" found under a log, also one of the larvæ, a "grub-worm." Our rustic population treat this bug very tenderly because of the good office it performs. It is said to afford an oil or drop of "blood" that is a present cure for ear-ache. Pulled in two one drop of liquid is found which dropped into the ear gives immediate relief. I also send two insect knots or nests, one from a weed and the other from a blackberry brier. They will produce some sort of insects next spring and may interest you, though it may only be a gnat. Chestnuts have been unusually wormy; can you devise any plan by which they may escape the ravages of the beetle?—[Calvin J. Cowles, Wilkesborough, North Carolina, November 27, 1890.]

REPLY.—The insect which you call the "Best" or "Bess" bug is the horned *Passalus* (*Passalus cornutus*). The use of this insect for ear-ache interests me very much. I think it must be comparatively a local idea. Is it not? The enlargements on the Solidago and Blackberry are the galls of two very different insects. That on the Solidago is made by a two-winged fly known as *Trypeta solidaginis*, while that on the Blackberry is made by one of the true gall-flies allied to the species which produces the commercial galls. It is known as *Diastrophus nebulosus*. So far as I know no good remedy has been proposed for worms in chestnuts.—[November 29, 1890.]

Phorodon Notes from Oregon.

I have been examining plum thickets in this (Lane) county, in the vicinity of hop yards and I find thousands of eggs of the hop louse (*Phorodon*). Further, I have found earlier in the autumn specimens of *Phorodon* on plums near by and also on others a number of miles from any hop field. The variety of plum upon which so

many eggs were found is known as "Peterson's Seedling" or "Peterson's Drupe," the nearest approach to a wild plum which we have here. I have advised the burning of these (useless) thickets. Doubting Thomases say: "How can you prove to us that those eggs on the plum are not those of some other aphid, plum aphid for instance?" And I reply by saying that the plum aphid does not begin to be abundant enough in this section to produce a tenth part as many eggs; further, I fall back upon the result of your investigations in Europe and America, and also the fact that I have observed *Phorodon* on the plum in large numbers this fall earlier in the season. I can not show them an egg of the plum aphid for comparison, even if there is a difference between the two. Neither can I with certainty obtain any plum aphid eggs. Could you conveniently send me a few eggs of this latter insect now? Upon my inquiring of them, hop growers, as to whether they burned their vines immediately after gathering the fruit, they invariably replied they did do that, but further inquiry elicited the fact that said burning does not take place until after the vine is all withered, when the louse has left them. I pointed this out to them and urged very strongly indeed their burning the *green* vines *immediately* after picking, as they pick. Does not this agree with your idea?

The fact that I have found the *Phorodon* on plums at least 2 miles from hops leads me to ask if I understand your statement in your summary (1888 Report) that "they do not migrate readily from one hop yard to another." I found no eggs upon the following trees, though growing among the hops: Bradshaw plum, yellow egg plum, Italian prunes, Petite Bows. Two damsons growing in the same situation were not examined, but will be shortly, and the result with cuttings sent to me at Corvallis. I should be gratified to hear expressions of your opinion on various points in this letter, and if you could oblige me in the particular of Plum Aphid eggs I should appreciate the favor.—[F. L. Washburn, Corvallis, Oregon, November 30, 1890.]

REPLY.—I am much interested in your letter of the 30th ultimo and am pleased to learn that you have so speedily fulfilled my predictions with regard to the stocking of plum by return migrant *Phorodon*. Your information regarding the variety of plums infested also interests me. As to distinguishing the eggs of *Phorodon* from those of other plum-hibernating Aphididæ, I can hardly assist you by sending you authentic eggs of what you call "Plum Aphid," for the reason that there are several plant lice which oviposit upon Plum in the fall in the Eastern States and in England, and I am not sure which one, if any of these, you have in your vicinity. It is safe to say, however, where *Phorodon* has been migrating in its usual numbers from hop to Plum that its eggs will so vastly exceed in number those of any other species that you can not fail to recognize them. I may say, however, that the eggs of *Aphis pruni*, which somewhat resemble those of *Phorodon*, are larger and rather lighter colored. I certainly indorse your advice as to burning the old vines immediately after picking, as this is what I have myself recommended. You have misunderstood my statement which you quote, to the effect that the lice do not migrate readily from one hop yard to another. To be more explicit, migration from hop yard to hop yard is through wingless individuals, which is slow or even impossible at long distances, while the winged return migrant instinctively quits such fields for *Prunus*. The statement above referred to means just what it says and nothing more, and in my complete report (not yet published) I have called attention to the fact that the return migrant generations in the fall will fly long distances in search of plums. This fact was also brought out in Mr. Howard's notice of my investigation in the *Country Gentleman* of November 17, 1887. In other words, the non-tendency to migrate to any distance holds only as between hop yards.—[December 8, 1890.]

A Southern Roach in a Northern Greenhouse.

We send you by this day's mail a small box containing a live roach and a frond of *Lastrea aristata variegata* (Fern). The roach was caught on the fern, and we have every reason to believe that they are their enemies. I hope you may gain some facts

from the live roach.—[J. Otto Thilow, Philadelphia, Pennsylvania, December 4, 1890.]

REPLY.—Your favor of the 4th instant, with accompanying box containing a specimen of cockroach, came duly to hand. The roach is *Periplaneta australasia* Fabr., and you are no doubt correct in stating that the injury to your *Lastrea* is due to this insect. I am not aware that this particular species has been reported before as being injurious to greenhouse plants, but I know that a closely allied species, viz., *Periplaneta americana*, occasionally infests greenhouses and feeds upon various plants. *P. australasia* is a cosmopolitan species, but by no means so universally distributed and so common as the Croton Bug, *Phyllodromia germanica* or *P. americana*. It is abundant in Florida, and perhaps also in other Southern States, but I do not know whether it has fairly established itself in any of our Northern cities. I would beg you, therefore, to let me know whether this species is common in your greenhouses or elsewhere in your neighborhood, or whether only a few specimens were accidentally imported with plants from tropical countries.

As to remedies for roaches, I refer you to my article on household pests in INSECT LIFE, Vol. II, p. 266, a separate copy of which is sent you herewith.—[December 8, 1890.]

The Grape-root Prionus.

Please let me know the particulars of this bug. I took this from some California vines. They were sent from California to Dallas, Texas, 4 years ago, and were planted in Dallas 2 years, but did not fruit. I brought them to the plains last spring. Upon taking them up nearly all the vines have these bugs upon them.—[A. Rawling, Marienfeld, Texas, November 30, 1890.]

REPLY.—The specimen which you send is a full-grown larva of one of the large long-horn beetles known as *Prionus imbricornis*. These larvæ have been previously recorded as feeding on the roots of grape, but are comparatively rare and are not considered to be very serious enemies of the vine. Nothing can be done in the way of remedies except to dig the larvæ out by hand.—[December 10, 1890.]

A New Native Currant Worm.

I send you by this mail one male parent of a native Hymenopterous currant worm, the same as was noted a year or two ago by Professor Lintner in his New York report. I first bred one pair in 1887 from larvæ grown in 1886, and this was raised in 1888-'89. The springs of 1888 and 1890 I was not able to find any. Please report name, etc.—[E. W. Allis, Adrian, Michigan, December 3, 1890.]

REPLY.—This insect is without doubt *Janus flaviventris* Fitch (see Fitch's seventh report, species No. 12). This discovery of yours is a very interesting one, if the insect works in the way described by Lintner in his fourth report, page 47.—[December 5, 1890.]

Insects from Montserrat, West Indies.

I now send you in spirits :

(1) A fly found in the near vicinity of the Galba tree when the *Icerya* was so bad. This fly I also found in thousands on a fig tree close by.

(2) Some of the female *Icerya*.

(3) A piece of wood off a fig tree in close proximity to the Galba, which is covered with cottony-cushion blight.

(4) A yellow kind of Lady-Bird, also found on the *Ficus*.

(5) A smaller and whiter Lady-Bird.

The Galba tree had been cut down and lopped up ready to burn, so as to destroy the blight, so it was hard to find what was wanted ; but I caught No. 1 flying round the dying branches. I then discovered the same flies on a hog-plum tree adjoining

and shortly afterwards in thousands on a fig tree close by, one of the common *Ficus*. I also found Nos. 4 and 5 on this tree when I had it cut down. The tree was literally smothered with the cottony-cushion blight, No. 3. I could find none of No. 2 on the *Ficus*, although it was in close proximity to the Galba, but I found No. 2 on the cocoa trees, sour sap (*Anona muricata*), hog plum (*Spondias lutea*), Galba (one of the Sapotaceæ), and on a wild vine, name unknown. I hope I have found what you want, but doubt it; if not, will try again. I also send in tin box some woolly cocoons that were found in numbers in the Cassava leaves. They seem to be full of eggs.—[H. de C. Hamilton, Plymouth, Montserrat, West Indies, November 11, 1890.]

REPLY.—I have sent you by today's mail a copy of No. 3, Vol. III, of INSECT LIFE, upon pages 99 to 103 of which you will find your insect described as *Icerya montserratensis*. I opened your box with a great deal of interest, hoping to find that the "fly" found by you in the vicinity of the Galba tree was a male of the *Icerya*. I was disappointed however to find that it was a beetle of the genus *Eros*, a very much larger insect than the male *Icerya*. I found, however, male larvæ, and if you will kindly try another sending of living *Iceryas* we may yet succeed in getting the male. The fig tree is infested by another cottony scale belonging to the genus *Pulvinaria*, species undescribed. The two insects which you call Lady-birds do not belong to that group of beetles, but to the closely allied leaf-beetles. The one is a species of *Luperus* and the other seems to be a species of *Monocesta*. Neither of these is carnivorous in habit. I am much obliged for the additional list of food-plants of the *Icerya*, and shall be glad to learn from you just how much damage is being done by this species and whether a remedy seems to be necessary. The objects which you call woolly cocoons are masses of the small cocoons of a parasitic insect of the genus *Apanteles*, the larvæ of which have probably issued from some large caterpillar and spun their cocoons in these masses in the Cassava leaves. One of these objects, however, was the case of a so-called bag-worm, and of this I should be pleased to receive further specimens if you can get them without too much inconvenience.—[December 10, 1890.]

The Desirability of Importing the Blastophaga for the Smyrna Fig in California.

I have recently noticed a newspaper clipping from your paper referring to the experiments made by Mr. F. Roeding, of the Faucher Creek Nurseries, and Mr. George C. Roeding, the manager, with the cross fertilization of the Smyrna fig and the Capri fig. This Department is anxious to correspond with one of the Messrs. Roeding on this subject, and would like very much to know their post-office address. Our principal object at present is to find out how many Capri figs they have growing in their nurseries, how large they are, and whether they are growing close together, in order to judge as to the possibility of establishing the fertilizing Blastophaga of Europe in this country. I inclose a return envelope and beg that you will drop me a line giving me the address of the parties mentioned.—[November 18, 1890, to editor of the *Fresno Expositor*, Fresno City, California.]

Your favor of the 18th instant to the editor of the *Fresno Expositor* has been handed over to me by that gentleman, and in reply I will say that I have many thousands of the wild or Capri figs, as well as the true Smyrna, having imported from Smyrna several thousand cuttings of each variety, as well as a number of cuttings of other varieties, mostly table figs. Three years ago we sent our superintendent to Smyrna for the express purpose of obtaining these figs; he remained there 4 months, and after having made a close study of the modes of drying, packing, etc., went into the Aidin district, where the best Smyrna figs are grown, and not only secured cuttings of the Cebeli or commercial figs, but also obtained a large quantity of the wild figs. Over 30,000 cuttings were secured, but half of these were left at the London docks on account of the heavy freight charges, the remainder having been shipped to Fresno, arriving May 24, 1887, in good condition, although they were 7 months on the road.

I have just answered a letter from H. E. Van Deman, esq., on this subject, and I trust your Department will make every effort to introduce the Blastophaga here, as it is the only link wanting to successfully produce the Smyrna fig in this country. I have been in correspondence with R. J. Van Leup, Dutch consul at Smyrna, now deceased, but he informed me that he could not discover where the insect hibernated and therefore could not introduce any into this country. Dr. H. H. Behr, vice-president of the Academy of Sciences in San Francisco, who has taken a deep interest in the fig question, has discovered, with the assistance of Mr. Brandagee, who has lately been traveling in South America, both the wild fig and also the Blastophaga, of a different family, however, than found in Smyrna. If your Department does not succeed in introducing the insects, we have, I think, some chance of bringing them here in good condition, the journey not being so long and hazardous as from Smyrna. The insects should not arrive before the middle of June or the first of July, as the wild fig does not set fruit before June 1 and does not ripen its fruit before July 1, this being the time when the Smyrna fig is ready to receive the pollen. Any further information desired by your Department will be cheerfully given.—[George C. Roeding, Fresno, California, November 29, 1890.]

REPLY.—I am much pleased to learn of your success in growing the Capri fig in California, and beg to assure you that this Department will do everything in its power to introduce the Blastophaga into this country. Your nursery will undoubtedly be very well adapted to the purpose, and if success follows our effort a supply will be immediately forwarded to you. I note what you say in regard to the proper season of the year, and any additional suggestions which you care to make will be acted upon.—[December 10, 1890.]

The Cabbage Worm Disease.

In the November number I was glad to see a report from Prof. Herbert Osborn, on the use of contagious diseases in contending with injurious insects. In 1883 my attention was called to the disease (Muscardine) affecting the Cabbage Worm, by Prof. S. A. Forbes, who sent me specimens of the diseased worms, from which I succeeded in propagating the disease among the healthy worms on my cabbages, and which spread rapidly over all the cabbages in my yard. I also succeeded in introducing the disease among the worms in two other yards. Before that time the disease had not been observed in this locality. I preserved a quantity of the diseased worms in a dry state in a closely sealed box, and on July 20, 1884, I powdered the dry remains of the worms in the box and sprinkled it on a head of cabbage infested with the worms. In four days, on the 24th, the disease began to show itself on the worms, but I found no dead ones until the 28th, when it had affected nearly all the worms on the head on which I had applied it. After emptying the box in which I had kept the dead worms, I put in a number of healthy worms with fresh leaves of cabbage, and in 5 days the disease had begun to show itself on nearly all of them. I did not find the disease on any other cabbages in the yard until the 2d of August, when I noticed it on plants adjoining the one where it first started and on which I had sprinkled the contents of the box, and in a few days it spread over the entire yard. In 1885 I had cabbages on the same ground as the year before the larvæ commenced their depredations. A little later I first noticed them on the 25th of July, and on that day found one that was affected with the disease. By August 10 it had spread over the entire lot. My notes for 1886-'87-'88 are lost.

In 1889 the disease was first observed September 5, when it spread rapidly, and by the 15th I could find only a very few recently hatched worms unaffected. August 24, 1890, I found the first diseased worms. On September 4 I sent a number of diseased specimens to Dr. A. P. Buatts, Shreveport, Louisiana, as he was desirous of trying its introduction on the cotton bollworm. On September 15 the disease had destroyed all the worms on my cabbage, and although many of them had been badly

eaten, the season was favorable and I had a good yield of cabbages. In conclusion I would say that since 1884 I have made no effort to preserve the disease, and it has made its appearance each year about the 1st of August. My cabbage has been planted each year on nearly the same ground. This year the worms were later in showing themselves. The disease has become pretty general through this locality, and has proved of great benefit. I found this year the larvæ of a Geometrid affected with the same disease.—[E. R. Boardman, M. D., Elmira, Stark County, Illinois, December 15, 1890.]

An Orange Plant-bug from Australia.

Herewith I inclose specimens of a beetle which is very destructive to the orange crop in this district by eating the young and tender shoots. If you have the same pest, I should be glad to have anything bearing on the treatment of trees affected with the pest.—[Thos. G. Hewitt, editor *Northern Star*, Lismore, New South Wales, Australia, October 25, 1890.]

REPLY.—The insect is not a beetle, but the immature form of one of the true bugs. We have nothing very similar to this insect in this country, and it will be impossible to determine the exact species without receiving full-grown individuals. It seems to be identical with a form which Mr. Koebele found both in Queensland and New South Wales, sucking the sap of the tender twigs and the fruit of the orange. We have an insect in Florida, known popularly as the Red Bug (*Dysdercus suturellus*), which works in a somewhat similar manner, and it has been found there that the best remedy is to spray the tree while the bugs are at work, with a dilute kerosene-soap emulsion, a good formula for which I inclose on a separate sheet. The insects are also easily trapped by placing under the tree a small heap of decaying fruit of any kind, and they can be destroyed upon this heap by the use of hot water, preferably in the early morning. We will be glad to have you send a large series of specimens of this insect, as well as any other crop pests which may be prominent in your vicinity.—[December 15, 1890.]

On Parasites of Lepidoptera.

Prof. C. Rudow must surely have made some mistake in the list of parasites published in the last number of *INSECT LIFE*, kindly sent me from your Department. No less than seven species of *Mesoleius*! Ratzeburg gives a few Tryphonidæ as having been bred by Brischke from Lepidoptera, but Brischke in his list, published several years after Ratzeburg's last volume, does not mention any *Tryphon*, *Mesoleius*, or *Bassus* as having been bred from Lepidopterous hosts, so a mistake must have occurred somewhere. It certainly requires a very large amount of faith to believe that Rudow, or any one else, bred five species of *Bassus* from a Lepidopterous host, and besides there are two species of *Phygadeuon*. The only Tryphonidæ I have that were bred from Lepidoptera are:

Parasite.	Host.
Phytodietus scabriculus	Tortrix costana.
Grypocentrus genalis M	Micropteryx semipurpurella.
Sphinctus serotinus	Limacodes testudo.
Triclistus holmgreni Holm	Tortrix decretana.
lativentris Holm	Emmelesia alchemillata.
Exochus decorator H.....	Peronea maccana.
	hastana.
alpinus.....	Pædisca solandriana.
	Phlæodes tetraquetrana.
	Penthina dimidiana.
	Euchromia flammea.
flavomarginatus	Eudorea truncicolella.
fletcheri M	Gelechia notatella.

<i>Parasite.</i>	<i>Host.</i>
<i>Exochus pictus</i> H.....	<i>Endorea murana.</i>
<i>consimilis</i>	<i>Homeosoma nimbella.</i>
<i>tibialis</i> H.....	<i>Gelechia populella.</i>
<i>Triclistus squaliclus</i>	<i>Botys terrealis.</i>
<i>Chorinaeus funebris</i> Gr	<i>Rhodophaea formosella.</i>
	<i>Eupoecilia angustana.</i>
<i>cristator</i> Gr.....	<i>Tortrix decretana.</i>
<i>Metopius dentatus</i>	<i>Bombyx callunæ.</i>
<i>Eclytus fontinalis</i> H.....	Host uncertain.

All my other bred Tryphons have been from saw-flies, except Tryphon signator from Crabro leucostoma, Spleophaga vesparum from Vespa vulgaris, and one Bassus from fly cocoon. It seems strange that he should have bred so many Tryphonids from so unusual a host. I must confess I do not believe it.—[John B. Bridgman, 40 St. Giles, Norwich, England, November 22, 1890.

Unslaked Lime against the Rose Chafer.

Myself and son had last year some 22 acres of grapes to fight the rose chafer on and had nothing ready to fight them with. I went 5 miles and hired a spraying machine and purchased a quantity of lime and carbolic acid, used the dry lime some, but used the lime water most, found dry lime would soon blow off; used the liquid very strong. I used 1 bushel of unslaked lime (on some 1½ bushels) to 1 quart of acid (crude) and 50 gallons of water; dissolved the lime and strained. We gave the dose freely and our vines looked white when we got over them. It took us 4 days to cover 20 acres. We lost no grapes by bugs after they got the dose. Don't be afraid of lime; it never killed a vine, but it is a good fertilizer. Some of my vines had the lime sticking to the leaves at the close of the season, and grew black and rank from its effects.

I had the fairest test that could have been given; had three vineyards and only a driveway between them. The middle place of 1 acre of mixed kinds lay in the center—it had pear trees and currants set among the vines so I could not get through with the machine and as I did not lime them lost the entire crop. These were set as full as any, and across the driveway where I limed them they were full of grapes, so I know the lime killed them. We treated my son's 10 acres first, and he had a heavy crop. On some of my own the bugs worked on the last we sprayed, but the Inez and a new variety which I originated, called the Garfield, neither bug nor rot affected as they had shed their blossoms mostly before they came; they take the Concord and Brightons every time. Neither Paris green nor London purple will affect the bug. The lime shuts off their breathing. The trouble with the dry lime is that it blows off. We only went once over our vines. Shall begin sooner this coming season and go twice over and also use sulphate of copper in connection with the lime for brown rot which we were troubled with this year. The bug does most of his work inside of one week and at time of blossoming. I used about 6 bushels of lime on 20 acres of 7-foot high trellis. The spray should be thrown up on under side where bugs and fruit are. We used a low sled to carry tank on. For that purpose a wagon is too high; liquid runs off.—[S. Justus, Mentor, Ohio, November 27, 1890.

Abundance of Bombardier Beetles.

Herewith I transmit to you some insects collected in Minnesota by me while engaged as teacher of the Natural Sciences at the State Normal School, Winona, Minn. There is one lot of beetles to which I wish to direct attention especially; it consists largely of species of *Brachinus*. These I picked up all under one large flat stone near Trempealeau Mountain, Wis., on May 17th of the present year, while on a collecting trip after botanical and zoological material. For several years past I had taken

pleasure in directing the attention of my students to these interesting little Bombardier beetles, the *Brachinus*, which I always could readily find along the bluffs near Winona by turning up stones. They were generally found in colonies of from ten to almost thirty individuals, and were rarely associated with other insects. On this occasion, near Trempealeau, the colony consisted of many hundreds of Bombardiers, and included a number of species of other beetles, mostly small Carabids. Being all agile species they scampered away to find hiding places at a lively rate. But there were so many of them that we succeeded in a minute or two in capturing several hundred of them. This intrusion and interruption of family peace was, however, bitterly resented by the Bombardiers keeping up a regular and audible fusillade against their assailants, creating an unpleasant odor and producing a brown stain on our hands which did not yield to soap and remained till worn off.

I took my captives home alive and for a day or two I succeeded in getting them to "perform" their shooting feats by teasing them. I kept them in a deep glass vessel so that they could be seen readily, and I hoped to keep them a long time. But on the fourth or fifth day all died. Under ordinary circumstances I have kept beetles alive for weeks; in this case I suspect that the Bombardiers were their own executioners. The brown caustic dust or spray emitted by them seems to have had a deadly effect on them, confined as they were in a glass dish; for while the odor became perceptible at a distance of 2 or 3 feet, I think that the specific gravity of this defensive vapor emitted by the *Brachinus* is probably so great that the bulk of it remained at the bottom of the dish, thus smothering them.—[John M. Holzinger, Assistant Botanist, Department of Agriculture, Washington, D. C., November 3, 1890.]

Some New Parasites from California.

Herewith inclosed find a specimen of *Chalcis* which I have reason to believe is parasitic on *Chrysobothris mali*, Harr. The latter is our "Apple-tree borer" in this country, and that it also bores the peach I have this year proved by breeding it from the stems of young peach trees that were infected. These I had in a glass jar, the mouth of which was covered with netting. Nothing else than *Ch. mali* emerged from the wood, except this one example of *Chalcis*, which I one day found in the jar.

The other hymenopter inclosed is a parasite of the larva of *Papilio zolicaon*. The latter feeds upon Umbelliferae, chiefly *Carum Kelloggii* and the common Dill, which grows abundantly near gardens from which it has escaped. Before the larva is fully grown this parasite emerges and spins a little yellow cocoon, fastening the same upon the stem of the plant. I bred a number of these years ago, but being of no especial interest I never reported them to anyone.

The *Chalcis*, however, is of value because it preys upon one of the worst enemies of the orchardist, and it is well to make this known.—[L. E. Ricksecker, Santa Rosa, California, September 8, 1890.]

REPLY.—The supposed parasite on *Chrysobothris mali* is, according to the old classification of the subfamily Chalcidinae, a new species of the genus *Chalcis*. According, however, to the recent extension of generic characters it forms a new genus. I should hesitate to describe a new genus from a single specimen, particularly as this one which you send has the tips of both antennae broken off. I hope, however, that you will make an effort to breed additional specimens. This form is one of extreme interest, and, as you state, of considerable economic importance. The parasite on the larva of *Papilio zolicaon* is a species of the genus *Apanteles*, but as the abdomen and both antennae are gone, it will also be impossible to describe this. I am of the opinion, however, that it is a new species. If you succeed in getting other specimens of these two interesting insects I would urge you to send them on; but, in order to insure safety in transmission, the box in which they are contained should be wrapped in cotton and inclosed in another box.—[September 14, 1890.]

A Tomato Root-louse.

* * * Two years ago, while in the employ of the Atchison, Topeka and Santa Fé Railroad, I happened, while I was visiting Albuquerque (about 100 miles south of Santa Fé, in the Rio Grande Valley), to meet a French gardener, who mentioned to me that a peculiar disease had attacked his tomatoes, and that out of six hundred plants only two had escaped alive. Last year, in June, I was at a village named Los Corrales, 12 miles north of Albuquerque, on a visit of some days' duration at the vineyards of another French gentleman named Louis Alary, when I noticed in his garden a number of tomato vines that appeared yellow and sickly; in fact, many of them already in full bloom were dying. I dug up several of the vines, but discovered no apparent cause for the malady, except that the rootlets seemed to have shrunk and were drying up. I attributed this to the corroding effect of the alkaline salts (the Mexicans call them salitre—saltpetre), which the water of the Rio Grande, used for irrigation, holds in solution.

Some days since, at the place of Mr. Valentine Herbert, a German gardener of Santa Fé, I remarked the same peculiar appearance on his tomato vines, and he told me that he had already dug up many of them which had the same disease, which had been noticed by him for the first time in 1888. As the water in Santa Fé contains no alkali, being formed of pure snow and spring water that flows down from the adjacent mountains, my theory was at fault. I took a spade and dug up a few vines. In examining the ground and the roots I found what I now believe to be the cause of the disease; quantities of a large white root-louse. It is when full grown about the shape and size of a flaxseed, and moves about quite briskly when disturbed. I have preserved about a dozen of these insects in a small vial in a mixture of alcohol and water, which I shall send you, and also some roots of the diseased vines. I feel convinced that this root-louse is the destructive agency which kills the vines, for no plant attacked ever survives to bear fruit.—[John F. Wielandy, Santa Fé, New Mexico, August 6, 1890.]

REPLY.—The insect on the roots of tomato which you call a Phylloxera is a Mealy Bug of the genus *Dactylopius*, and probably a new species. What you have to say concerning the damage done by this insect is very interesting and entirely new to us.—[August 27, 1890.]

Ticks from Texas.

I shall send you by to-morrow's mail a box containing insects. You will find in a little square bottle four different kinds of ticks, if size, shape, and color are essential to make a species, but my neighbors think those little ones are the young of the old ones. I dropped some alcohol on them to keep them from decay. They are a terrible pest. The largest one is the most common; the one with a white spot on its back is called Scotch tick; it gets into the horses' ears and causes them to lop down. The third size is called "Seed tick;" it is very abundant in hot weather. The fourth size is generally called Jigger; it is very irritating when it gets on anybody. The two largest kinds are active all winter in southeastern Texas, and are the cause of the death of many a poor cow. Old axle grease seems to be the best remedy.—[F. W. Thurow, Hockley, Harris County, Texas, August 22, 1890.]

REPLY.—The two large ticks are the male and female of *Amblyomma maculatum* Koch. Those with the white dot are *Amblyomma unipunctatum* (americana Koch) Pack., female, and the little ones are the young of the latter species.—[August 30, 1890.]

Flights of Dragon Flies.

Please accept my sincere thanks for your interesting letters in answer to my questions about the Dragon Flies. Yesterday they were on the wing again and flying in the same direction as always before. I send you by mail a couple of them. You ask if these flights have been noticed before. I have often noticed them, and for many years back, but as I made no memorandum of the occurrences I can not say positively

how often, but feel sure they occur every year, and more than once each year, occupying about the whole day in their flight.—[J. J. Brown, Sheboygan, Wisconsin, September 5, 1890.]

REPLY.—I received this morning from you a box containing a couple of Dragon Flies, which I take to be the species which you have noticed in swarms. An examination shows that it is *Æschna eremita* Hagen.—[September 11, 1890.]

On the Oviposition of Tachina.

The letter of Mr. B. D. Wier in INSECT LIFE, vol. III, p. 26, contains matter very interesting to me. I was much surprised at the account of the manner of oviposition of *Tachina* given by Mr. Webster (vol. II, p. 256), and was at a loss to account for it, as it differs from published accounts (see A. C. Weeks, *Ent. Amer.*, III, 126) and from my own experience, but the present letter throws considerable light upon it. The habit of the large parasitic Hymenoptera seems to be to fly up to the larvæ at once and attack by a sudden thrust, when the victim usually drops to the ground, as observed by Mr. Wier. Quite in contrast to this is the stealthy approach of the *Tachina* fly. It will alight near a group of *Datana* larvæ and approach by walking, as it seems to be aware that the noise of its wings would cause alarm. It will approach as nearly as possible to the head of a larva and stealthily deposit one egg after another, the ovipositor passing under the body and out beyond the head. At the slightest movement of its victim the fly will run away and again slowly approach, but is loath to take to flight. I observed this process this season in the case of a number of *Datana perspicua*, and I also noticed that the *Tachina* oviposited only upon larvæ in their last (fifth) stage, which is an evident protection, as if the eggs were laid upon younger larvæ they would often be cast off in molting before they had hatched.

Mr. Wier seems to think that the larvæ of *Datana* are not attacked by *Tachina* on the tree; but I have often observed this, especially in the "hairy form, on the black walnut" (*D. integerrima*), which really appears to be more subject to attack than the "smooth form" (*D. ministra*). This double parasitization of *integerrima* (Mr. Webster's "*ministra*," are probably *integerrima* as well as Mr. Wier's "hairy form") must result in benefit to it, since both parasites can hardly mature from one larva, but must one or both perish.

Another fact that I have observed must also tend to check the destruction of *Datana* by parasites, namely, a protective habit developed by the insects themselves. It consists in rubbing the head where *Tachina* eggs are most usually laid with considerable force on the branch or twig, in many cases serving to dislodge or injure the eggs. That this is a habit, and not due to irritation caused by the presence of eggs, I have proved, by observing that it is freely done by *Datana* that are not infested and have been bred in the house from the young larvæ. Of course this habit is most marked in the last stage, as this is the time when they are subject to *Tachina* attack, as I have shown. I have observed the habit in *Datana integerrima*, *ministra*, *drexelii*, *major*, and *perspicua*, but not strongly in the last.—[Harrison G. Dyar, Rhinebeck, New York, September 2, 1890.]

Fig Beetles.

I this day mail you a box containing a half dozen small insects of the kind which destroyed my fig crop last year (1889), and are fast using up my present crop. If you will kindly tell me what they are, and can point out a remedy that promises safety to my figs, I shall be obliged indeed.—[J. M. Fullinwider, Palestine, Texas, August 16, 1890.]

REPLY.—The small box accompanying your letter contained two species of beetles, known as *Carpophilus mutilatus* and *Epuræa luteola*. Both of these beetles confine their attacks to decaying or injured fruit, and will not attack healthy figs. So I think you are mistaken in supposing that they destroy your crop. Please make a closer examination as to the cause of the damage.—[August 25, 1890.]

SECOND LETTER.—If these beetles “confine their attacks to decaying and injured fruit” then my fruit (figs) must be injured very strangely, and while yet only four-fifths grown.

I have a number of very fine trees bearing fine, large fruit. This kind, as it approaches the full-grown state and begins the ripening process, slightly opens at the apex or bud end. No sooner does this very slight aperture form than these insects enter and feed upon the fruit, and I judge live therein. In the very early part of the season, for perhaps a week after ripening begins, we are not seriously troubled. After that it is difficult to find a single fruit unmolested by these pests. The crop of 1889 was utterly destroyed by them after the first eight days. The crop of 1890 has been destroyed, or is still in process of destruction. The trees are very healthy and fine, the fruit also, so far as I can discover. But the process outlined above continues. If I fail to discover the nature of the trouble and to secure an efficient remedy therefor, I must and will be forced to abandon my fig crop.

We esteem the fruit so highly that we are loth to yield to this result. Hence my application to your Department.—[J. M. Fullinwider, Palestine, Texas, August 29, 1890.]

REPLY.—From the facts which you give, it seems as though in the case of the fig these two beetles have really become pests and injure sound fruit. They will be difficult enemies to fight, on account of their entering the orifice of the fruit, and hence not being amenable to any treatment with sprays. The only remedy which I can suggest is derived from the known preference of these insects for decaying fruit, and is the use of rotten or damaged fruit as traps. At the time when this insect enters the fig, scatter about the tree some such decaying fruit, picking it up and burning it after it has become infested with the insects, *i. e.*, after the beetles have gathered upon it and laid their eggs. There can be little doubt that they will prefer such rotten fruit to the sound figs, and many of them can doubtless be trapped and destroyed in this way. If the lure fruit be sprinkled with arsenic it may save the trouble of subsequent collecting.—[September 4, 1890.]

The Weeping Tree Phenomenon.

Inclosed please find an insect, the name and habits of which you will oblige me by giving. I found it on a willow tree in a swamp on Island 73, in the Mississippi, belonging to Arkansas. I was hunting deer, and being tired lay down under a small willow to rest. After lying there a few moments the air suddenly became filled with little drops of water as if rain or mist were falling. I got out from under the tree and as soon as I moved the mist ceased. I stood a short distance away and watched, and gradually came closer, and after watching for half an hour I discovered this little bug on a twig. When I first saw it, it was perfectly quiet, but soon put its head to the limb and immediately minute drops of fluid began to be ejected from the rear end of its body which extended past or even with the ends of its wings, but since its death has shriveled to its present length. The leaves of the tree on which I found it were pierced in thousands of places, and the mist from the tree was thick; but this bug was not on a leaf, but on a small limb. I could find no other insects on the tree, but know there are hundreds. The one I caught slipped around the limb very much as a squirrel would, and I had difficulty in catching it. It made no effort to fly. The natives of the island called the tree a weeping tree, and are very superstitious about it.—[R. J. McGuire, Rosedale, Mississippi, August 30, 1890.]

REPLY.—* * * The insect which you send is one of the so-called leaf-hoppers, which has been frequently referred to in print on account of its habit of ejecting honey dew and causing the phenomenon of so-called “weeping trees.” The scientific name of the one which you send is *Proconia undata*. I send you by accompanying mail a copy of No. 5, Vol. II, of the Periodical Bulletin of this Division, and you will find upon page 160 an account of a similar instance.—[September 4, 1890.]

Injury to Asters by the Black Blister Beetle.

I had a grand bed of China Asters, which in two days has been wholly destroyed by an army of bugs, of which I inclose two specimens. How are these bugs generated? Is there any remedy against them? Is it necessary to get new seed?—[Prof. A. Sabetti, Woodstock, Howard County, Maryland, August 28, 1890.]

REPLY.—The insect which you send is the common Pennsylvania Blister Beetle (*Epicauta pennsylvanica*), and a remedy will be a difficult matter, although it will not be necessary for you to get new seeds. This insect breeds in the ground, usually feeding in the early stages on the egg pods of grasshoppers. The adult beetles fly readily, and often damage various crops, such as beets, potatoes, and beans, and are found very abundantly upon the flowers of the golden-rod, where they engage in eating the pollen. The damage to China Aster has been frequently noticed, and during the time when these insects are abundant there is no remedy except constant watching, or inclosing the plants in gauze.

It is possible that if the flowers are sprinkled with a strong whale-oil soap solution they will be distasteful to the beetles, and sprinkling them with London purple or Paris green, in the proportion of a tablespoonful of the poison to a bucket of water, will kill all of the beetles which begin to eat the plants; but if their numbers are very great, this course will probably not save the flowers.—[August 29, 1890.]

Isosoma Notes from Washington State.

In *Experiment Station Record*, Vol. 1, No. 5, page 277, I notice that the Saw-fly Borer (*Cephus pygmaeus*) in wheat is spoken of as being found in New York, but no further record is given of it. I believe they are widely distributed over eastern Washington. In my field I find from one to four worms in almost every good, healthy stalk. In those spots where the wheat has "burned" there are none. I have noticed them here for at least two years, but not so many as there are this year. I believe that our way of harvesting by heading will favor them, for they will have time to reach the roots to winter there. I send you some straws which contain them.—[Hans Mumm, Rosalia, Whitman County, Washington, August 16, 1890.]

REPLY.—The insect which you send, and which you find in your wheat stems, is not the Wheat Saw-fly (*Cephus pygmaeus*) which the Experiment Station Bulletin mentions as having been found in New York State and probably recently imported from Europe. It is, on the contrary, the Wheat Isosoma (*Isosoma tritici*), an insect which is closely allied to the common Joint Worm of Wheat, Rye, and Barley in the East. You will find this insect treated in the Annual Reports of this Department for 1881-'82 and 1886. They do not, as you suppose, burrow down into the roots, but transform to pupæ in about the same portion of the stalk in which you find them. In other words, they travel very little. Your method of harvesting is particularly favorable to their development provided the stubble is not burned soon after harvest.—[August 27, 1890.]

The Texas Mule-killer Again.

I send this day by mail another specimen of the insect referred to in my letter of August 4, and which was lost in the mail, for identification and opinion regarding its poisonous effects on horses and mules, when accidentally swallowed.—[J. O. Skinner, captain and assistant surgeon, U. S. Army, post surgeon, Fort Davis, Texas, September 5, 1890.]

REPLY.—The insect which you send is the common Thick-thighed Walking-stick (*Diapheromera femorata*). The story that this insect is poisonous to horses and mules is absurd. I have heard it on several other occasions, and it has always come from the State of Texas.—[September 11, 1890.]

Insects Identified.

I send by this mail, with a request that you identify them, three insects: No. 1 was found on a stone walk near my house; No. 2, on a lettuce plant; and No. 3 was captured to-day on a tomato plant. I also send in a small vial some flies, of which I would like to know the name. I first observed them about three weeks ago, clustered about the trunk of a Lombardy plum tree, but afterwards found them on apples and pears, and even on currant bushes. They did not seem to injure them in any way, but in every instance were found on the bark where it presented a rough appearance. Possibly they were sucking the sap from the trees.

Hematobia serrata (R-D.) has been quite numerous here this fall. I first observed them about the middle of August, but in no instance have I seen the cow's horn covered as thickly as shown in your illustration on page 101 of INSECT LIFE, Vol. II. I do not remember ever having seen these insects before this season, but that was probably owing to the fact that I took no interest in entomology before the publication of INSECT LIFE was begun. * * * —[John D. Lyons, lock box 5, Monticello, New York, September 17, 1890.]

REPLY.—No. 1 is *Monohammus confusor* Kirby; No. 2, *Cyrtene robiniae*; No. 3, *Euphoria inda*; and the "flies" are *Psocus venosus*.

The Red Scale of the Orange in Syria.

By this mail I send you an orange fruit and two leaves of the orange tree. For the past three years an insect has been destroying the fruit, and it is gradually becoming more and more abundant, until the orange growers are getting alarmed for the future. The Governor of Tripoli (district) has requested me to see if I can get any information with regard to its possible destruction. I have an impression that a similar disease attacked our oranges in Florida. Am I right? If you can, through your department, give us any advice as to the best way to kill the pest, you will confer a great obligation, as well as a blessing on the orange growers of this place. In Sidan and Beyrout this disease appeared about four years ago, but it did not appear here until 1888.—[Ira Harris, Tripoli, Syria, August 25, 1890.]

REPLY.—A careful examination shows no other cause of damage than a few specimens of the red scale of the orange (*Aonidia aurantii* Mask.), a species which is found in Australia, New Zealand, California, and the countries bordering on the Mediterranean. I inclose on separate sheets copies of two formulas for mixtures, which are used in this country with success, for spraying trees infested with this scale.—[September 20, 1890.]

SECOND LETTER.—I thank you very much for the prompt answer to my request for a diagnosis of the disease on the orange trees here. When I sent a translation of your letter to the Governor, he was very much astonished, as he did not think it possible to get an answer from you so soon; for he knew that with Syrians such a request as I made would take months to get at the question. The custom of this country is "Never do to-day what can be put off until tomorrow, and not then if you can get some one else to do it for you." The Governor in a letter sends his thanks to you, "for your excellency's kindness in our troubles."

I send you a literal translation of his letter to us, of thanks. I have hopes that the treatment will have the effect of destroying the pest, and if it does, it will be of infinite benefit to many poor men who depend upon the orange crop for a living.

TRANSLATION OF INCLOSURE.—My beloved honorable Dr. Harris, the American, who is found in Tripoli: I received with loving hands the letter of your excellency, dated October 23, 1890, which contains a sending of the translation of the answered letter that came to your Excellency from the Secretary-General of the Department of Agriculture in the United States, with the prescription which is sent concerning the use of the necessary medicine to prevent the injury which has the influence on some of the

orange trees in Tripoli. And because the energy which you and your country show concerning this subject is reckoned one of service, which is worthy of praise, by His (God's) help the prepared treatment shall be of hasty effect; and your works towards home shall be useful and righteous. Now, my dear sirs, we, to show our gratitude to your delightful energies, begin writing this letter of sincerity. May you all live long.—[Ibrahim Hekky, Governor of Tripoli, October 24, 1306.]

Orange-tree Borers.

I send you this day, per post, section of orange tree trunk, in which you will find living specimens of a new (to me) borer. The trees affected are three 10-year old *bearing* trees, thrifty and thoroughly cultivated, good crop, and covered with new growth. Have used for fertilizer nothing but hardwood ashes and cow manure, the latter well composted with pine straw and oak leaves and all thoroughly decomposed, but no fertilizer at all since January. A few days ago when passing I was struck almost dumb to find the leaves of one tree curled where the ground was full of moisture. Upon looking for the cause I could detect none even at the root, so I thought a salamander had cut the tap root; on a second visit yesterday, I supposed I had a genuine case of *Mal-de-Goma*. The bark at the ground was all loose and gave off an offensive odor (soursap), but no exuding sap at any point; the bark was frayed in several places, but with no excrescence of gum or sap. As I glanced up the trunk I saw innumerable tufts of sawdust, as they projected from *pin-holes*. To-day I visited other trees in the neighborhood, and found two more in same condition, although not so far gone. One clew I followed with a chisel and hammer 2½ inches into the heart of the tree, and there discovered the 6-legged rascal which I also inclose in tin box. This chap had pierced the healthy bark and worked all the way in solid wood. I expect the bark is stung and the eggs deposited therein, from which this formidable foe is hatched.

The land is A 1 pine and oak, and the affected trees are 50 and 80 feet respectively from the timber, which is on the west. The entire grove was scrubbed with potash and whale-oil soap emulsion last winter, and I know of no other that has equaled it in growth and healthfulness this season. Now, can you tell me who he is, and what I must do to be saved?—[Frank W. Savage, Eustis, Lake County, Florida, August 27, 1890.]

REPLY.—The matter of which you write is one of considerable interest, and the beetle which you send is a common Southern bark-borer known as *Platypus compositus* Say. It has been the universal experience of entomologists that this insect bores only into such trees as are diseased from some other cause, and it is therefore quite unlikely that it is the primary cause of the damage to your orange trees. From your description I should say that the trees infested by this beetle have been first attacked by the "*mal de goma*," and that the beetles have been attracted by the diseased condition. Only a thorough examination upon the spot can determine this point, and I hope that you will make a report of your observations.—[September 1, 1890.]

Notes from New Mexico.

Inclosed I send you a few specimens of insects collected by me. They were all taken on the grounds of Mr. Valentino Herbert, a fruit grower and gardener in Santa Fé. I also put in the box two plums, that have obviously been stung by an insect which is not the curculio (*Conotrachelus nenuphar*). The latter beetle is entirely unknown in New Mexico, and in consequence the plum, apricot, nectarine, etc., succeed to perfection, and bear perfect fruit of the finest quality every year.

In the little vial you will find the tomato root-louse I have found recently on the roots of this vegetable, and about which I wrote you in my last. I had never heard of it before, but I find that it exists in all New Mexico, and must have existed for many years, although no one here seems to have known the reason why the vines

turned yellow and perished. The infection spreads from a center, and gradually extends from plant to plant in a row. No doubt you know the insect. In the vial I inclose the *Epilachna corrupta* in the chrysalis form. I am now perfectly acquainted with the transformations of this insect. It has only one brood in this region, and the light-yellow beetle in the box is the newly hatched insect from the chrysalis, which gradually turns of a darker shade and hibernates in the beetle form, probably in the ground.

The *Epilachna corrupta* has been very destructive here this year, and has taken off at least one full half of the bean crop. I would caution you against the recommendation of Paris green. It appears that the bean plant can not stand the corrosive influence of a solution even as weak as 1 pound to 150 or 200 gallons of water, and from my experiments I am satisfied that it kills the plant much more quickly and effectually than the insect does, without destroying the latter to any perceptible degree. We will have to look for another insecticide.

I would like to know something about the wingless insect of the wasp family that I send with the other specimens. The large insect of the May or June bug class is not, fortunately, very abundant here. Its grub is very large, and cuts through the roots of a big lettuce or other vegetables in short order.

The apple-tree borers are unknown in New Mexico, and the only insect injurious to fruit is an introduced one from the "States," the Codlin Moth. This season it is less numerous than others, probably from the warfare against it by natural enemies, for no one here would think of applying other means to destroy it.—[John F. Wieldy, Santa Fé, New Mexico, August 19, 1890.]

REPLY.—A careful examination of the two plums sent shows that they contain no insects. The external depressions are simply gnawings, probably of some small caterpillar. The insect on the roots of tomato is a *Dactylopius*, probably a new species. What you have to say additional concerning the damage done by this insect is very interesting and entirely new to me. The wingless insect of the "wasp family" is one of the so-called Cow-Ants (family *Mutillidae*) known as *Sphærophthalma castor*.—[August 27, 1890.]

GENERAL NOTES.

MIGRATORY LOCUSTS IN AUSTRALIA.

The Australian newspapers for the past three months have contained frequent mention of the ravages of migratory locusts. The species concerned does not seem to have been definitely determined. Mr. Koebele, in Bulletin No. 21 of this Division, refers to the damage done by *Chortologa australis*, and states that on a trip of 300 miles north of Adelaide, South Australia, he met with large numbers of this insect traveling south in search of food. He was informed that they migrate only in exceptionally dry seasons. They travel according to his observations, not in clouds, but scattered and never very high, just as did *Caloptenus devastator* in California in 1885. In the December number of the Agricultural Gazette of New South Wales (vol. I, part 3, p. 287) the species is mentioned as the "plague locust," which is determined by Mr. W. Froggatt as *Pachytilus australis*, Brunn., and the species is figured upon Plate VI. The statement is made that this species had appeared in large numbers at Hay, Corowa, New South Wales, and in the Wimera district, Victoria. We are indebted for most of our information, how-

ever, to the columns of the *Leader*, published at Melbourne, Victoria. A large number of localities are given in Victoria and New South Wales near the Victoria line. From the accounts in this paper it seems that the young locusts make their appearance in the last of September and in October and November, become winged towards the end of March, and lay their eggs in April. The habits of the species seem very similar to those of the Rocky Mountain Locust (*Caloptenus spretus*) and although there is no hint of such a state of affairs in any of the articles which we have seen, we are of the opinion that the species has permanent breeding grounds from which it flies out and overruns the cultivated districts further south and east, just as does *spretus* in this country. The same general laws will, in fact, be found to govern. Only the most rudimentary remedies are mentioned. The use of brush harrows, brush and chain harrows, hot water, and spraying with kerosene emulsions have been tried against the young locusts, but against the migrating swarms nothing effective has been proposed.

Later information than this just given from the *Leader* is given in the February number of *Garden and Field* in an interesting article entitled "Wandering Locust of South Australia; Its Breeding Places and Checks," by J. G. O. Tepper. The species is there determined as *Epaeromia terminalis*, and the habits given correspond with those described above. It is recommended that the most strenuous efforts be made to destroy the unfledged locusts during the period from August to the beginning of October. For pastoralists, the best remedy is to ascertain the extent of the breeding places and drive as large a flock of sheep as can be conveniently mustered and crowded as much together as possible up and down the locust-infested field, taking care to cover fresh ground at every passage on the same day. It is recommended that this be kept up 2 or 3 days, after the locusts are permitted to re-unite. This is often of some avail after the swarms become winged. Spraying young swarms with kerosene is also recommended, and an additional suggestion is made that the field be fired some distance behind the spraying parties. The article concludes with a description of the method of coping with locusts in Cyprus.

We have just prepared an emergency bulletin on the subject of the destruction of locusts, for use in this country, in which we have summarized the best remedies, and shall take occasion to send a few copies to some of our Australian correspondents.

SOME OREGON WORK AGAINST NOXIOUS INSECTS.

Mr. F. L. Washburn read an important paper before the Oregon State Horticultural Society at the annual meeting held January 13 and 14 at Portland, of which we have seen the following review in the *Pacific Rural Press* of February 7. In some successful experiments in spraying with Paris green against the Codling Moth he mixed 6 pounds of soap with 50 gallons of the liquid with good results, causing a thin spread-

ing of the poison over the leaf and apparently rendering the poison more tenacious. As against the Woolly Aphis he believes that the best solutions are the resin washes. Whale-oil soap in solution and carbolated whale-oil soap may be added, one-half pound true carbolated soap to one-half pailful of soap thinned with a strong solution of washing soda. As against the Peach-borer he recommends wrapping young trees with newspaper from the crotch to 2 or 3 inches below the collar. He also states that washing the trunks with the carbolated whale-oil soap alone and with the resin washes would cause almost entire exemption from borers.

OVIPOSITION OF DECTES SPINOSUS.

In the March number of the *American Naturalist* (vol. XXV, p. 294) Dr. C. M. Weed presents a short note on the oviposition of this Cerambycid beetle in the stem of the horse-weed (*Ambrosia trifida*), which is substantially as follows:

A single female was seen standing head downward on the stem, the outer fibers of which she had gnawed away and after three trials was observed to insert her ovipositor and deposit an egg, after which she withdrew to the top of the plant. The egg was deposited obliquely in the pith about two-thirds of the way from the bottom to the top and on the opposite side of the stalk from which the beetle stood. The egg, a figure of which is given, is described as elongate-oval, slightly curved, of a pale yellow color and 2 millimeters long by 0.3 millimeter wide.

REMEDIES FOR THE YELLOW SCALE.

The Yuba County (California) horticultural commission, in their fifth bulletin recommend the resin wash for *Aspidiotus citrinus*. They also recommend washing freely with cold water in the evening or early morning during the months of July, August, and September, with a view of washing off and destroying the young insects which are then crawling about over the tree. Fruit growers are discouraged from relying upon the little parasite of this scale, as the original tree upon which this insect was discovered in March, 1887, is still very badly infested with scales.

THE FLOUR MOTH IN CANADA.

The provincial board of health of Ontario has published recently an appendix to Bulletin No. 1, which we mentioned in our article upon the Mediterranean Flour Moth upon page 166, vol. II, of *INSECT LIFE*. The pamphlet is issued for the benefit of millers and produce men. It seems that no answers were received to the board's request for information of the appearance of the moth, and that an inspection of the principal mills and supply houses in Toronto was therefore made, with the result that the pest was found in several of the large establish-

ments. The board, in its appendix, expresses its regret that its efforts have not been seconded by the persons more immediately interested, and in view of the loss which the reputation of the province in the matter of pure grain and flours would sustain in its export trade, publishes the penalties attached to any violation of the statutes in the matter of selling unsound grain and flour, and threatens to give due publicity to all violations. The measures to be taken in stamping out the pest are published again.

A NEW ENEMY OF THE FALL WEB-WORM.

Mr. J. C. Duffey, of the Missouri Botanical Gardens, has recently published in the Transactions of the St. Louis Academy of Science, vol. v, No. 3, a paper entitled "Transformations of a Carabid (*Plochionus timidus*) and Observations on a Coccinellid Enemy of the Red Spider." The larvæ of the Plochionus were found in the webs of *Hyphantria cunea* feeding upon the web-worms and from two to twenty of these Carabid larvæ were found in nearly every web. By July 1, the *Hyphantria* larvæ had entirely disappeared. The same state of affairs was observed with the second brood of web-worms, which began to appear July 22. Soon after this date, the adults of *Plochionus* made their appearance in the webs, laid their small white eggs in numbers, and from these larvæ soon hatched and began feeding upon the web-worms. Thirty-two of the Carabid eggs were found in a portion of the web covering a single mulberry leaf. The larvæ reached full growth in 16 days and remained in the pupa state from 9 to 12 days. The pupa state was passed in the web and indeed the entire life round of the insect, as observed by Mr. Duffey, was arboreal. Mr. Duffey thinks that the insect hibernates as a beetle, but of this he is not sure. Short descriptions of the newly hatched and full grown larvæ are given and rough figures also accompany the article. The second portion of the paper treats of *Scymnus punctum* and of its feeding upon the Red Spider. Descriptions of the full-grown larva and pupa and figures of the same are also given. Miss Murtfeldt made similar observations on the *Hyphantria* feeding habits of *Plochionus* last year and sent us notes thereon, but learning that Mr. Duffey was about to publish his interesting observations which had priority we withheld those of our agent.

A CHERRY-TREE BORER IN MAINE.

Mr. G. Warren Smith, of Rockland, Maine, who is a large cultivator of cherries at Camden in that State, called on us recently and reported very great injury to his cherry trees by what is evidently, from his description, the cherry-tree borer (*Dicerca divaricata*). The trees are injured most during the third and fourth year of their growth and the work is not confined to the trunk, but extends to the small branches.

THE EGYPTIAN ICERYA.

This insect, treated in No. 3 of the current volume, is attracting great attention in Egypt. Through the kindness of Mr. Louis B. Grant, acting consul-general at Cairo, and of the Department of State, this Department has received copies of publications from Alexandria and Cairo from which it seems that the insect is even more injurious than our previous information, through Mr. D. Morris, led us to suppose. It is by no means confined to fig trees, but has attacked oranges and lemons. It will be remembered that Mr. J. W. Douglas founded for this insect the new genus *Crossotosoma*, and that after an examination of his figures and description we decided to place it in *Icerya*. We have recently received letters from Mr. Douglas who has also very kindly sent us specimens of the adult female and the newly hatched young from which we are able to confirm our conclusion. The insect is unquestionably an *Icerya* and a good species. Mr. Douglas himself admits our generic placing, but thinks that the characters of the genus will have to be added to. Professor Brocchi, of Paris, has also written us that he has had specimens sent him from Alexandria and that he is fully convinced that it is an *Icerya*, while he even goes so far as to state that in his opinion it will prove to be identical with *I. purchasi* of Australia, South Africa, New Zealand, California, Mexico, and the Sandwich Islands. He states that the specimens which he has received lack the tapering processes so characteristically shown in Mr. Douglas' figure, which we have reproduced on page 98 of this volume, and that, in any event, he considers these processes as of no specific value.

While we are ready to admit that we have seen a tendency towards the formation of such processes in *I. purchasi*, they have specific value when specialized as in *egyptiacum*, as their production must depend upon some peculiar grouping or other modification of the secretory pores. Moreover, the specimens of *egyptiacum* entirely lack the black hairs which are so characteristic of the adult female of *purchasi*, while the eggs are smaller and of a pale yellow rather than of a bright orange color. The newly hatched larvæ are so nearly alike, that we are unable to point out distinguishing characters from the greatly shriveled specimens received.

Since the publication of our article we have also been in correspondence with Rear-Admiral R. W. Blunfield, R. N., Deputy Commissioner General of Ports and Light-houses, Alexandria, Egypt. Prof. William Wallace, of the Agricultural College at Gizeh, has published a newspaper statement, also forwarded by Deputy Consul-General Grant, in which he records considerable damage to citrus trees at Cairo, and states that he has found that the insects may be washed down by throwing a strong stream of water into the tree.

Adverting again to the statement originally published to the effect that "a breeze sends the cottony pest down in all directions," and to our conclusion on page 99, that it is evidently the processes that are

thus broken off and fall, and that the insects themselves are not so dislodged, it has occurred to us that where the insect occurs in such enormous numbers as here described, the collection of this white wax by spreading a cloth under the trees and shaking them may prove to be a matter of some economic importance, as the wax is absolutely pure, and we should say of equal quality with the white Chinese wax secreted by *Ericerus pé-la*, having the advantage of not being mixed with the bodies of the insects. If we owned an infested orchard in Alexandria or Cairo we should at least mold our own wax candles.

CHINESE WAX.

Garden and Forest for January 28, 1891, contains a long review of Mr. Alexander Hosie's "Three Years in Western China." In the course of the review some mention is made of his investigation of the white-wax industry of the plain of Chien-Chang. From the account it transpires that the so-called insect tree of the Chinese is *Ligustrum lucidum*. An account of the industry is given, which, while probably accurate, enough from a practical standpoint, is undoubtedly incorrect from the entomological point of view.

The wax is said to be an excretion of the male only, and the entire account is so confused, that if we had not already an accurate idea of the history of these insects from the writings of older authors we should be at a loss to place them in their proper group in the Homoptera.

A NEW ZEALAND FROG-HOPPER.

We have recently received from Mr. T. F. Cheeseman, Curator of the Auckland Museum, specimens of *Ricania discalis* Walker,* a handsome little Flatid, which Mr. Cheeseman writes has become exceedingly plentiful around Auckland during the last 8 or 10 years. It occurs, according to his statement, on nearly all plants with long succulent shoots. The common cultivated passion fruit is particularly liable to its attacks, and the branches are often covered with it for several feet in length. He states that when very numerous it is evidently harmful to the plants, weakening them very much.

THE GREEN BEETLE PEST IN AUSTRALIA.

We have received, through the kindness of Mr. George H. Wallace, U. S. Consul General of Melbourne, Australia, a communication from Mr. C. French, F. L. S., Government Entomologist, relating to *Diphucephala colaspidioides* Gyll.

It appears from Mr. French's letter that this insect is becoming a serious enemy to fruit grown within 10 miles of the seacoast. It is described as a small green beetle about four lines in length, belonging to the family Scarabæidæ and subfamily Melolonthinæ and conse-

* Kindly determined for us by Mr. P. R. Uhler.

quently allied to the destructive *Lachnosternas* or "White Grubs" of this country and to the European "Cock-chaffer." The genus is confined to Australia, twenty-three species having been described.

It attacks various trees and shrubs, particularly cherry, peach, and plum trees, and hawthorn hedges. Its appearance in numbers was first noticed by Mr. French in limited localities in 1858, since which time its increase has been rapid.

His observations concerning the species and recommendations for its destruction are substantially as follows: They make their appearance about October, just at "cherry time," and continue till Christmas. Cherry and plum trees are stripped of their leaves, often causing them to wither and die. They appear often in swarms, and their work is described as resembling that caused by locust attacks. In a single day they sometimes commit great havoc. The life habits of the species remain to be investigated. The eggs are believed to be deposited in sandy soil and the larvæ descend further into the ground soon after hatching. Newly hatched beetles have been observed coming up through the sand in the most scrubby flats.

To extirpate the pest, burning, beating, scalding, rolling, and spraying are recommended. To accomplish best results the beetles should be attacked when they first make their appearance and before they have completely matured. In the early morning, before the sun has waked them into full activity, they are sluggish, and can then be easily destroyed. They may be beaten from the trees and afterwards destroyed by sprinkling with kerosene or by scalding with hot water. One plan which has been resorted to, where they attacked hawthorn hedges, is to beat along the hedge, and as the insects rise burn them with roughly made torches. They do not fly high, and this method is therefore effective. Millions, it is said, may be destroyed by this simple, inexpensive process. On calm days the beetles may be dislodged from infested trees by lighting directly under them small fires upon which may be thrown a few handfuls of sulphur. The "smoking-out process" is of no avail in combating these insects, as they merely leave one orchard to fly to another, and when the coast is clear they are free to return. Mr. French urges upon orchardists and others who have suffered from the depredations of these beetles the necessity of immediate action in ridding the colony of a pest which threatens every year to become more formidable.

THE BITE OF LATRODECTUS.

Mr. C. Frost, in *Victorian Naturalist*, vol. VIII, No. 9, pp. 140-143, records some experiments on *Latrodectus scelio*, and gives some cases of its injurious effect on man. Three experiments were performed, two on rats, one on a dog. In one case the rat lived, but showed effects of blood poisoning. In the other case the rat died. The dog, when bitten by the spiders, howled, but was not otherwise affected. In spite

of these experiments, the author thinks that the bite is often accompanied by very serious results. The author mentions several cases reported by doctors in which a man was bitten by "a black and red spider," all of which were followed by some ill consequences of varying degrees. Dr. Hearn gives by far the best evidence. He had treated six cases, in four of which the spider was seen. He himself was bitten and saw the spider; the leading symptoms were excessive perspiration and acute lumbar pains. One case was fatal; a child 3 months old died 6 hours after the bite.

MATTERS IN CALIFORNIA.

The popularity of organizations for the enforcement of regulations against injurious insects in California may be gauged, perhaps, by the fact that at the regular meeting of the Campbell (Santa Clara County) Horticultural Society, held on the 14th of March, the question "Shall we have a county board of horticultural commissioners?" was discussed and unanimously decided in the negative. Some few individuals favored the plan on the supposition that the commissioners would act only as quarantine officers, but upon learning that it was not proposed to so restrict their duties, they took the opposite stand. In opposing the measure, it was argued that the State board had been more or less of a failure, and certain speakers referred to the recent disinfection of peach trees shipped from the east into Para County as an instance. One gentleman stated that he found live borers in eight out of ten of the disinfected trees.

We regret that inefficient work on the part of the State board has led to this feeling, for organization is unquestionably necessary in fighting insect pests in this State above all others. The unpopularity of laws in this direction does not, however, always depend upon the inefficiency of the executive body, and opposition has always arisen from negligent fruit growers, who apparently insist upon their right to raise bugs if they wish to do so. The system of fines which is usually proposed is always strongly antagonized, and the right of an inspector to visit and examine a man's premises and the condition of his crops is frequently considered an infringement of the personal rights of the owner. The fruit dealers under the local laws in parts of California are also at the bottom of a great deal of opposition, and they undoubtedly have the power to influence many fruit raisers. We notice, by the way, from the *California Fruit Grower* of January 10, that a Riverside fruit dealer was recently fined \$10 for selling fruit infested with the San José Scale.

We also learn that the State board had a close fight for existence before the legislature this winter. A bill for its abolishment was introduced and received strong support, but was finally defeated. Another bill, however, appropriating \$5,000 to send a man to Australia

to study and collect the natural enemies of injurious California insects, particularly the Red Scale, was passed with very little opposition.

HOME-GROWN PYRETHRUM IN CAPE COLONY.

The following notes on this subject have been sent to me by Mr. Wilson, nurseryman and gardener, at Waterford, the estate of the late Mr. Irvine:

The Dalmatian Pyrethrum I had from you is not half sufficiently well known, or everybody rearing cabbage and cauliflower plants would most certainly not be without it. I find it the best thing I ever had through my fingers for young plants in seed beds when attacked by the Cabbage Aphis, or as it is commonly called, Cabbage Louse. When the flowers are gathered, dry them quickly, and then rub them down very fine. Bottle up the powder and cork it well to exclude the air and keep in the strength. Use one part of the powder to ten times its measure of fine flour. I find this sufficiently strong, if well mixed together. Dredge the infested plants through a piece of fine netting. The Aphis disappears at once, and very seldom it has to be used a second time on the same plants. It should be applied early in the morning, while the dew is on the plants, or the plants may be damped with a syringe or the fine nose of a watering pot. There is also a good deal of strength in the leaves for this purpose, and I propose to increase my stock largely this season.

There is little reason to doubt that this mixture of pyrethrum powder and flour would clear an orange tree of the black Aphis, and most likely of the scale too. In Portugal Chamomile is grown under or among the orange trees as a preventive against insect pests. Any one may easily try the effect of the Persian insect-powder, and if found to be effective, possibly some day we may have colonial-grown pyrethrum powder plentiful enough to dust over orange trees and other insect infested trees, in a way which shall rid them of all the insect pests which now so constantly infest them.—[J. B. Hellier, in the *Agricultural Journal*, November 13, 1890.

POPULAR LECTURES ON INSECTS.

We notice by the *Birmingham Daily Post* that our valued correspondent, Mr. F. Enock, has begun popularizing entomological knowledge by a series of lectures. The most flattering account is given of the one upon the Hessian Fly, which was illustrated by the aid of lantern views of some of Mr. Enock's wonderful microscopic preparations. As a preparator of objects of this kind Mr. Enock has few equals, and we consider ourselves fortunate to possess a number of his best mounts. He is well fitted for the work which he has undertaken.

JOURNALISTIC ENTERPRISE.

Mr. William H. Edwards, of Coalburgh, West Virginia, sends us the following:

In the *Christian Union* for the 12th instant, which I have just been reading, on p. 335 is a statement that some one "in Arizona captured a *butterfly* which he sent to the Smithsonian. In a few days he received a cheque for \$1,500 (*sic*) with the request

to make careful search for other *moths* of the same kind. It was an individual of a *fossil species* supposed to be extinct, and great was the excitement of the scientists at the discovery that one of the race had recently been alive." Could not find another. "It seems to have been a Rip Van Winkle among its kind, *sleeping its long sleep* unobserved at the root of a century-old tree."

Can you tell me what all this is based on? What was found or taken; if there is any truth at all about it?

This statement has absolutely no foundation in fact, and as a pure fabrication seems rather out of place in a religious journal of the character of the *Christian Union*.

ENTOMOLOGICAL EXCURSION.

The Entomologists of New York, Brooklyn, Newark, Philadelphia, and localities near these cities are invited to attend the second annual field meeting to be held under the auspices of the Entomological Societies of these cities, at Jamesburgh, New Jersey, on July 4, next. Jamesburgh is on the Amboy division of the Pennsylvania R. R., and may be reached from New York *via* Monmouth Junction at 7.20 a. m., Newark 7.50 a. m., Philadelphia, Broad Street, 6.50 a. m., Camden, 7 a. m. Later trains leave New York *via* Rahway and Philadelphia on the Long Branch division; but it is urged that the early train be used, as this will bring the party into Jamesburgh at the same time. All those desiring or expecting to attend will please notify one of the members of the committee, from whom also all further information can be obtained. The notification is important, in order that proper arrangements may be made at Jamesburgh.

Committee.—C. P. Machesney, 65 Broadway, New York. Dr. Hy. Skinner, Amer. Ent. Soc., Logan Square, Philadelphia. Prof. J. B. Smith, New Brunswick, New Jersey, H. W. Wenzel, 1117 Moore Street, Philadelphia, Pennsylvania.

OBITUARY.

The science of entomology has met with several serious losses by the hand of death since the publication of our last number. Mr. Edmond André, of Beaune, Côte d'Or, France, a well-known hymenopterist and originator and publisher, as well as principal author, of the magnificent "*Species d'Hyménoptères d'Europe et d'Algérie*," is perhaps the foremost. Living in a retired spot, M. André has devoted his entire energies for the past 6 years to the publication of his great work, which we are glad to learn will not be permanently interrupted, but will be carried on by his brother Ernest.

The well-known writer upon American entomology, Dr. S. S. Rathvon, recently died at his home in Lancaster County, Pennsylvania. Although approaching his eightieth year, his interest in entomology was unabated. His life was a long one and full of usefulness, and our science is indebted to him not only for many important discoveries, but

for what he did as a propagandist and popularizer of entomology. For many years editor of the *Lancaster Farmer*, he constantly scattered through its columns articles upon insects, evincing not only great powers of observation, but also much scientific knowledge and a clear-headed practicality.

Dr. Felipe Poey is another veteran who has left us. Dr. Poey was a learned naturalist, working in an unexplored country, and his contributions to the various departments of descriptive and biological science have given him a name which is known in all countries. Although more interested in the higher groups, a very large part of our knowledge of the insect fauna of the island of Cuba is due to his untiring efforts as a collector and to his unfailing generosity. Cuba has hitherto not seemed a fertile field for the growth of naturalists, but Dr. Poey has left behind him several pupils who will continue the work which he has so well begun.

From the *Pacific Rural Press* of February 14 we learn to our regret that Mr. Waldemar G. Klee died of consumption in the first week of February, at the age of 38 years. Mr. Klee was a native of Copenhagen, Denmark, where he received a thorough education in horticultural science, and came to this country at the age of 19 years. He soon settled in California, where Prof. E. W. Hilgard employed him on the University Experiment Grounds at Berkeley, and for the last 15 years of his life his name has been intimately connected with the progress of Californian horticulture. In 1886 he was appointed State inspector of fruit pests, and while in this position he wrote, among other entomological papers, a handsomely illustrated "Treatise on the insects injurious to fruit and fruit trees in the State of California" (Sacramento, 1888). At the time of his death he held the office of Inspector of Experiment Stations of California.

ENTOMOLOGICAL SOCIETY OF WASHINGTON.

March 5, 1891.—Mr. Schwarz was elected corresponding secretary, *vice* Mr. Townsend, resigned. Mr. Schwarz then resigned his position on the executive committee, and Mr. Fernow was elected in his stead. Mr. Banks called attention to specimens of *Scolopendrella*, *Machilis*, and *Lepisma*, taken during the winter in Rock Creek, and commented on the specimens. Two papers by Professor Riley were read in his absence by Mr. Howard. The first was entitled, "Notes on the Life-history of *Megilla maculata*." It was an elaboration of a paper presented at a previous meeting of the Society, on September 4, 1890. He gave descriptions of the egg and larva which had hitherto never been described or figured, and also a résumé of the habits of the insect and larva. The larva, he stated, was altogether entomophagous, so far as known, while the adults feed largely on vegetable material, and also, to some extent, on soft-bodied insects, approaching more nearly in their food-habits, the genus *Epilachna*. He stated that the beetles are known to feed on the pollen of plants, the blades of corn, and also the soft kernel of the corn, wheat kernels, the larva and pupa of *Lina scripta*, the larva of *Diplosis tritici*, and other soft-bodied insects. The paper was discussed by Messrs. Schwarz, Turner, Howard, and Mann. Professor Riley's second paper was entitled "On the larva and some peculiarities of the cocoon of *Sphecius speciosus*," and was an elaboration of a note on the subject presented at a meeting of the society, September 4, 1890. Professor Riley gave a detailed description of the larva and drew attention to a remarkable peculiarity of the cocoon of this insect. This peculiarity consists in the presence of certain very anomalous pores which occur about the center of the cocoon, extending nearly around it. These, Professor Riley stated, must be intended for some special purpose, probably of ventilation or respiration. A general discussion followed the reading of this paper, relating to the breeding of larvæ and pupæ, especially in the case of subaquatic Coleoptera, and in Bombycids and other insects having dense cocoons.

Mr. Fernow presented a paper on the Nun Moth (*Psilura monacha*) which is published in full in the present number of *INSECT LIFE*, calling attention to its increase in Germany and Austria during the past year, to the great injury, particularly of the spruce forests. Discussed by Messrs. Howard, Schwarz, and others.

April 2, 1891.—The publication committee reported the issuance of No. 1, vol. II, of the Proceedings and presented a number of copies for the inspection of the society. On motion of Mr. Schwarz a copy of this number was ordered sent to each of the scientific societies of Washington. The president announced the death of the lately elected member, Mr. E. R. Tyler, and appropriate resolutions of sympathy and regret were passed and a copy ordered sent to the family of the deceased.

Mr. Banks presented a paper on mimicry in spiders. The author called attention to the fact that the mimicking spiders belong to two widely separated families, the Attidæ and the Drassidæ. *Synemosyna formica* was considered the most perfect in its resemblance to the ant, which insect all these spiders mimic. The various genera were compared, and the author decided that for purposes of deception, only superficial and unimportant parts had been modified. Discussed by Messrs. Schwarz, Howard, and Riley.

Professor Riley presented a paper on "The Habits and Life-history of *Diabrotica 12-punctata*." He first referred to an article relating to the food habits of the beetle, in volume I of *INSECT LIFE*, page 59, in which, by a typographical error, the insect is said to have "bred" upon, instead of "fed" upon melons, the first statement being justly called in question by Professor Garman in a recent article on this insect in *Psyche*. He followed with a record of his notes on the corn-feeding habit of the larva of this insect, which habit was first brought to his attention in the spring of 1883. During that year and the two or three years following he had succeeded in bringing together a full record of its larval habits, and an account was given of them. The data were obtained from a study of the insects in Mississippi, Alabama, Louisiana,

Maryland, and Virginia. All stages of the insect were described, and figures were shown illustrating the larva, pupa, and adult, and the nature of the injury done to young corn. Two Dipterous parasites were also referred to. Discussed by Messrs. Schwarz, Riley, Kuehling, and others.

Professor Riley then presented a paper entitled "The Mexican Jumping Bean—the Determination of the Plant." In this paper the plant was accurately determined for the first time. After referring to the literature on the subject, the various descriptions of the plant and the names by which it is known to the Mexicans, he described having recently received from Mons. P. Chrétien, a member of the French Entomological Society, an interesting communication relating to *Carpocapsa saltitans*, in which he referred to the plant *Colliguaja odorifera* Moline, of which *Croton colliguaja* Sprengel is a synonym. Shortly after this Mr. J. M. Rose, of the Botanical Division, brought him specimens of the plant, together with capsules, which had been collected by Dr. Edward Palmer. The plant turned out to be undescribed, and belongs to the genus *Sebastiania*, and will be described by Mr. Rose as *S. palmeri*, thus indicating the probable incorrectness of M. Chrétien's reference.

Professor Riley gave a description of the plant and some interesting notes on the names applied to it in Mexico and South America under the popular name Colliguaja. Two other closely allied species were also collected, and showed evidence of being infested by *Carpocapsa*, and Professor Riley believed that the insect develops in the capsules of different but closely allied species of the genus *Sebastiania*. Additional matter was presented relating to the character and description of these plants.

Professor Riley also called the attention of the Society to some interesting anomalies in the case of certain insects, which he exhibited. These consisted of two Noctuids, which showed a shortening of the wings on the left side. The deformity or aberration was considered to be undoubtedly due to chance in the case of these specimens. The other case was more interesting, and consisted in a bifurcation of the terminal joint of the left antenna of *Tregidion armatum*. The bifurcation is from the base of the joint, and the abnormal growth or branch is somewhat longer than the joint itself.

Mr. Schwarz presented a paper in which he reviewed the records of the food-habits of the North American Flea-beetles (*Halticini*), in the light of Dr. Horn's recent synopsis of this interesting group of Chrysomelid beetles. In connection with the published record of the food-habits of these insects, he pointed out certain species which were, in his opinion, either incorrectly named or of which the determinations were not reliable, and advocated that such doubtful records should not be used in future unless they were verified by additional observation or by an examination of the typical specimens. Discussed by Messrs. Riley, Schwarz, and others.

May 7, 1891.—The corresponding secretary reported having distributed 75 copies of No 1, vol. II, of the proceedings. Mr. C. H. Roberts, of New York, was elected a corresponding member, and Messrs. F. H. Chittenden and A. B. Cordley active members of the society. Mr. Howard exhibited specimens of *Bombus virginicus* which had been attracted in great numbers to the blossoms of a large horse-chestnut near his house, and described the peculiar actions of these insects possibly resulting from the toxic effect of the nectar. The note was discussed by Messrs. Riley, Schwarz, Marlatt, Ashmead, and Mann. Mr. Schwarz exhibited and briefly remarked upon the following Coleoptera: *Charistena lecontei*, found at Fortress Monroe, Va.; *Bagous sellatus*, found at the same place; *Sphærius politus*, found in Michigan and Alabama; *Lutrochus luteus*, from Michigan.

Dr. Marx presented a paper entitled "The Character of the Circum-polar Spider Fauna," in which he reviewed the literature relating to the distribution and description of the spiders from the Arctic regions in both hemispheres, and gave some interesting facts regarding the distribution and abundance of the different genera represented. He presented also a list of the genera and of the number of species belonging to each, and concluded with some remarks upon the spider fauna of

Alaska—a number of new species from which region he hoped soon to describe. The communication was discussed by Messrs. Riley, Banks, Fox, Schwarz, Fernow, Theodore Gill, and others.

Mr. Marlatt presented a note on the study of the ovipositor of Hymenoptera, in which he described, with the aid of figures, the character of the attachment of this organ to the abdomen in this order of insects, and pointed out certain inaccuracies in the previous writings on this subject. A close similarity of even minute details of structure was shown to exist in such widely separated families as the Tenthredinidæ, Chalcididæ, and Ichneumonidæ. The paper was discussed by Messrs. Riley and Howard.

Mr. Ashmead read a paper on "The Insect Collection of the Royal Museum at Berlin," in which he gave a full description of this justly celebrated insect collection, together with notes on certain interesting species contained in it. He described also the working force in entomology and presented some interesting comparisons of the nature of the work on insects in this museum as contrasted with similar work in this country. The paper was discussed at length by Messrs. Riley, Schwarz, Fernow, Howard, and others.

Professor Riley, under the head of "Miscellaneous notes," read short papers as follows: (1) Insects affecting the Agave, in connection with which he exhibited an interesting series of insects received from a correspondent in Texas, all of which had been collected from the flower stamens of the Agave or Century Plant (*A. dasylirium*). (2) The parasite of *Eleodes*, in which he described a peculiar Braconid parasite, a large number of the larvæ of which had issued from the abdomen of *Eleodes suturalis* and spun minute cocoons resembling those of *Apanteles*. These cocoons were arranged with remarkable regularity in straight rows along the angles of the box in which the beetle was confined. (3) Remarks on the Ox Bots, in which he presented facts showing that the species heretofore commonly referred to *Hypoderma bovis* was really *H. lineata*. He stated that all the specimens in the National Museum, representing nearly every section of the Union, had proved to be *lineata*, and this was also true in the case of the larvæ, of which a large series has been collected, all of which renders it doubtful whether *bovis* really occurs in this country at all, or, if it is found here, indicates that it is a comparatively rare insect. Specimens of *Hypoderma lineata* in different stages, together with figures, were exhibited. (4) A further note on the plant on which the Jumping Bean occurs. In this note Professor Riley referred to a letter just received from Prof. Sereno Watson, of Cambridge, accompanying specimens of seed pods of *Sebastiania bilocularis* and the moth bred therefrom. This moth Professor Riley found to be much smaller than *Carpocapsa saltitans*, and, in fact, to belong to another genus (*Grapholitha*), and stated that he would shortly describe it as *Grapholitha sebastianiæ*. He was of the opinion that one of the moths contained in a recent sending of the Jumping Beans, but which was somewhat injured and had been lost, was, without much doubt, the same species as the insect bred by Professor Watson. He also pointed out an interesting fact regarding the restricted locality in which, according to Professor Watson, the Jumping Beans are found, and stated that they are collected and sold by boys, and find a ready market.

C. L. MARLATT,
Recording Secretary.

SPECIAL NOTES.

The Locust of Northwestern India.*—Mr. E. C. Cotes has favored us with a copy of his final report upon the damage done by *Aceridium peregrinum* in northwestern India. We have already reviewed (INSECT LIFE, vol. II, page 332) a preliminary circular sent out early in 1890. The report before us definitely identifies the species as above, maps out the chief permanent breeding ground, and gives a tolerably full account of habits, recording the exact localities invaded by recent swarms. It seems that although all the other migratory locusts are single brooded, including even this same species in Algeria, in northwestern India egg-laying goes on more than once in a year in the same locality. It has been surmised that the eggs found in the autumn are only a second lot laid by the insects which had already oviposited early in the year; but, although the evidence is scanty, it seems probable that there is a tendency to two generations, as in our own species in southerly regions, the autumn brood being the offspring of the young locusts born in the spring, but perishing during the winter. The chief crops injured have been cotton, indigo, til, bajra, jowar, wheat, gram, and grasses. The locusts also destroy foliage of various trees, sirris, pekul, chir, and the various acacias having been noticed as suffering particularly. A great deal has been done by trenches and by hand collecting, although certain of the hill tribes have refused, on religious accounts, to coöperate in their destruction. In certain districts they were completely stamped out by hand work. In one district alone over 1,000 maunds (the legal maund is 87 $\frac{2}{7}$ pounds avoirdupois) have been collected. Generally speaking, the people have not made use of the locusts as food, but in Dharm-sala the natives utilize them largely, while in certain of the states of western Rajputana, where the Mussulman predominates, the poor collect and boil the locusts in salt water, obtaining in this way a supply

*The Locust of Northwestern India. Being a report upon an investigation conducted in the Entomological Section of the Indian Museum, by order of the trustees. With one plate. Government of India. Central Printing Office. No. 725 R. A. January 20, 1891. By E. C. Cotes.

of food both for themselves and for their horses and camels, which will eat the locusts and are said to thrive upon them. No natural enemies have been found except birds. The report concludes with a historical account of locust swarms in India as far back as 1812. The full-page plate illustrates the life-history of the species.

Agricultural Gazette of New South Wales.—We have received No. 3 of vol. I and Nos. 1, 2, and 3 of vol. II of this valuable publication. In No. 3 of vol. I we notice an account of the Elephant Beetle (*Orthorhynchus cylindrirostris*), a Curculionid which bores into Grape, Orange and other plants in New South Wales. A colored plate is given illustrating the different stages of the insect and its method of work. An account is also given of the Leaf-eating Lady-bird (*Epiluchna vigintioctopunctata*), which is one of the worst enemies of the Potato, Pumpkin, Tomato, and other solanaceous and cucurbitaceous plants in Australia, causing great damage to the foliage by feeding in the larval and adult states on the upper and under sides of the leaf. The life-history is given, and larva, pupa, and adult are figured. There is also a compiled article on the Grain Weevil, and a note upon the Plague Locust, with illustrations of both insects. No. 1 of vol. II contains nothing of entomological interest, but No. 2 of the same volume is notable from our standpoint. Mr. A. Sidney Olliff contributes a paper upon Lady-birds, which is illustrated by handsome engraved plates, showing six of the most notable Australian species. The same author furnishes a series of entomological notes, from one of which we notice that the Fig is damaged by a Thrips and the Potato by an unidentified flea-beetle of the genus *Graptodera*, while the Orange Rust Mite of America (*Phytoptus oleivorus* Ashm.) has made its appearance in two localities. Some account is also given of the Plague Locust. Mr. Olliff and Mr. N. A. Cobb jointly publish a paper on a species of *Cecidomyia* feeding on Wheat and Flax. The authors know the species only from the larva, of which they give a full description and illustrations. This number also contains the report of the committee appointed for the purpose of making awards in the competition of "spraying machines, spraying nozzles, and sprays" for the destruction of insect and fungus pests attacking fruit trees and vines, held under the auspices of the Department of Agriculture for New South Wales.

It seems that there were many entries in the competition and the certificates were awarded as follows: For spraying pumps drawn by horse, to the Messrs. Murray Bros., for the Farrington Pump and Cyclone Nozzle; for spraying pump drawn by manual labor, to Mr. T. A. Lyon, for the Federal Air Pump spraying machine; for spraying pumps carried by the operator, to Messrs. Murray Bros., for the Douglas Aquarius spraying machine; for spraying nozzles the award was given to the Messrs. Murray Bros., of Paramatta, for the "Triplex Cyclone" which

consists of three Cyclone nozzles fixed to a common base. In the class of insecticides no award was made, but the preference was given to Mr. Upfold's mixture, the ingredients of which are not given.

Part 3 of vol. II contains notes by Mr. Olliff on Paris green as a remedy for Codling Moth, the Potato Moth (*Lita solanella* Boisd.), a pest whose larvæ bores into and ruins stored potatoes, and the Brown Scale (*Lecanium hemisphericum*) on peaches.

Entomological work in West Virginia.—Mr. A. D. Hopkins, Entomologist of the West Virginia Experiment Station, occupies pages 145 to 180 of the Third Annual Report of the Station, Charleston, W. Va., 1890, with a review of the results of his work since taking office. He reports upon certain experiments which he has made against a number of farm and garden insects, but devotes most of his space to a consideration of certain forest and shade tree insects. He publishes original plates of the Raspberry Gouty Gall-beetle (*Agrilus ruficollis*) and of certain Locust Tree insects, viz: *Odontota dorsalis*, *O. nervosa*, and *Clytus (Cyllene) robinia*. His treatment of the enemies of the Black Spruce possesses the greatest interest for the general reader. The trees of this species have been dying off in great numbers in portions of West Virginia during the last nine or ten years, and it is estimated that at least a million and a half of dollars' worth of timber is now dead in the spruce forests of the State. Mr. Hopkins concludes that the death of the trees is the effect of two combined causes, one of which he does not attempt to explain. The other is the work of certain Scolytid beetles, principally *Polygraphus rufipennis* and *Xyloterus bivittatus*. He thinks that the ravages of these insects primarily succeeded some unknown injury to probably a few trees in isolated localities, and that when the conditions were no longer favorable to their existence in the injured trees, and they had increased to great numbers, they transferred their attacks to healthy trees from necessity. He reached this conclusion from finding the beetles at work in the green, sappy wood and bark. He found numbers of parasites of the bark beetles and considers them of great value in reducing the numbers of the pests. Mr. Hopkins has probably given too much importance to the damage done to these trees by the insects mentioned. No matter what their numbers may be, we doubt whether they attack perfectly healthy trees. A tree is usually injured in some way, or has become diseased from some cause, or its vitality has become impaired, before the beetles are attracted to or multiply in it.

An Italian Manual on Injurious Insects.—One of the most recent of the Hoepli manuals is a little treatise on noxious insects by Prof. Franceschini, "Gli Insetti Nocivi," Milan, 1891, press of Ulrico Hoepli. The

manual covers about 260 pages, and is illustrated by 95 woodcuts showing a number of injurious species and their work. The arrangement is not according to crops, as is usual in works of this character, but according to the systematic classification of insects. The little book is of a most convenient size and costs only two lire.

Insects and Insecticides.*—Dr. Weed's new book follows in about the same line with that of Franceschini. It is a handy volume of nearly 300 pages, illustrated with 143 cuts and 7 full-page plates. The arrangement is a convenient one, comprehending insects affecting the larger fruits, insects affecting small fruits, insects affecting shade trees, ornamental plants, and flowers, insects affecting vegetables, insects affecting cereal and forage crops, and insect pests of domestic animals and of the household. The introduction includes sections upon the metamorphoses of insects, their classification relative to the application of insecticides, natural enemies, the principal insecticides, methods of application, and collecting and preserving specimens. The treatment of the different species is similar in plan to that used by Saunders and Matthew Cooke in their manuals, and consists of a plain statement of the life-history, with figures of the different stages and a concluding paragraph upon remedies. The style is simple and non-technical and the important facts are condensed in a clear, concise manner. The first three parts of the volume are reprinted from the Report of the Columbus (Ohio) Horticultural Society for 1890, the last three only being original here. Owing to the condensed method of presentation the author has found it impracticable to give full credit to each observer from whose writings he has drawn, but he has fully accredited the illustrations in the preface. The work will prove useful to the fruit-grower, general farmer, and housekeeper, and will unquestionably meet a demand among those who have not access to entomological libraries.

Tertiary Insects of North America.—Vol. XIII of the Reports of the U. S. Geological Survey of the Territories is devoted to Mr. S. H. Scudder's Monograph of the Tertiary Insects of this country. Mr. Scudder has been at work upon this volume for twelve years or more, and he gives careful descriptions of 612 species, nearly all of which are figured upon beautiful lithographic plates. As the author states in his letter of transmittal, the publication of this volume will give the first opportunity for good comparisons between the long-known Tertiary insects of Europe and those of any other country. The material gathered shows that the fauna is at least as rich as that of Europe in

* *Insects and Insecticides. A Practical Manual Concerning Noxious Insects and the Methods of Preventing their Injuries.* By C. M. Weed, D. S. Published by the author, Hanover, N. H., 1891.

the lower orders of insects, if we exclude the amber fauna of the Baltic. The localities from which the material has been derived are, in the main, Florissant, Colorado; the White River, in western Colorado and eastern Utah; Green River, Wyoming; near the town of Fossil, Wyoming; at Horse Creek, in the same State; at Quesnel, British Columbia; Nicola, North Similkameen, and Nine Mile Creek, British Columbia; Scarborough, Ontario; and Port Kennedy Pennsylvania.

An Economic Bulletin from Canada.*—Mr. Fletcher has published in a little 30-page bulletin a condensed account of some of the more important of the insects inquired about by his correspondents during the past two seasons, together with remedies and the most convenient methods for applying them. His preliminary account of remedies, puts the matter in a very sensible, straightforward manner, while the remainder of the bulletin is occupied by the treatment of a few insects injurious to grain and forage crops, fruits, and vegetables, most of which have already received consideration in his last two annual reports, full notices of which will be found in *INSECT LIFE*, vol. II, page 336, and vol. III, pp. 359, 360.

Insect Enemies of the Sugar Beet.†—Mr. Bruner has in this publication summarized the particular enemies of the sugar beet in Nebraska during the season of 1890. As he has reported upon this same subject in Bulletin No. 23 of this Division, a summary will be unnecessary here, except to state that the article in the Bulletin of the Nebraska Station is illustrated fully and gives original figures of *Systema blanda*, *Disomycha triangularis*, *Macrobasis unicolor*, *Epicauta vittata*, *E. maculata*, *E. pennsylvanica*, *Geocoris bullata*, *Agallia siccifolia*, and *Melanotus communis*.

Nebraska Entomology.—We have received from Mr. Lawrence Bruner a copy of his report as Entomologist of the Nebraska Horticultural Society, extracted from the annual report of the society for 1890, pages 183 to 217. He gives a general essay on the subject of the damage done by insects and the necessity for a knowledge of insect habits, and follows with accounts of the Apple Root-louse, the Apple Aphis, notes on the Codling Moth, the Strawberry Monostegia, the Fiery Flea-beetle

* Central Experiment Farm. Department of Agriculture. Bulletin No. 11. Recommendations for the prevention of damage by some common insects of the farm, the orchard, and the garden. By James Fletcher, Ottawa, Canada. May, 1891.

† University of Nebraska. Bulletin of the Agricultural Experiment Station, vol. IV, No. 16. Sugar Beet Series No. 2. Lincoln, Nebraska, April 15, 1891. Insect Enemies, pp. 55-72.

(*Haltica ignita*), and certain sweet-potato insects, including the Tortoise-beetles and the Sweet-potato Saw-fly. He concludes with a consideration of insecticides.

Circular on the Hop Plant-Louse.—Judging from recent correspondence with the Hop Dealers' Exchange in New York, and with a number of prominent growers, the present year seems to be peculiarly favorable to the increase of the Hop Louse, which threatens more damage than we have had since 1886. We have therefore published as Circular No. 2, New Series, of this Division, a brief account of the life-history of the insect and the best remedies to be applied the present season. This circular will be sent to any hop-grower on application.

Locust Ravages of the Present Year.—The newspapers have contained many alarming accounts of ravages by locusts in different parts of the Western States during the months of June and July. Accounts of damage have been received from Texas, New Mexico, Kansas, Colorado, Idaho, Wyoming, South Dakota, North Dakota, Minnesota, Michigan, and Manitoba. We have taken steps to investigate all the rumors, and Mr. Bruner has been sent on a general tour of observation, while Professor Osborn has been sent to Kansas and Mr. Banks to Texas and New Mexico. Telegraphic correspondence with Professors Snow and Popenoe, of Kansas (who have been in the field during July), and with Professor Gillette, of Colorado, shows that the alarm in those States is caused entirely by local species. As we learn from Mr. Bruner, who has already visited the infested districts of Colorado, the species which is causing the alarm in that State is, curiously enough, a rather rare species known as *Dissosteira longipennis*. This insect breeds ordinarily in the sand hills among sparse vegetation, and the past two seasons of drought have conduced to its undue multiplication. The present season has been very wet, and the result has been a great abundance of vegetation in spots ordinarily comparatively bare. In order to seek more natural conditions, therefore, the locusts have migrated and have taken to the roads, where they were at once noticed and excited great apprehension. While occurring in roadways in enormous numbers, very few specimens were found a few rods away in the thick grass. Up to the present time no specimens of the destructive species *Caloptenus spretus* have been received from any of our correspondents, with the exception of a few from Larimore, North Dakota, and from the neighborhood of Winnipeg. The alarming rumors, therefore, of a possible repetition the present year of the great swarms of the Rocky Mountain locust which invaded the sub-permanent and temporary regions in the years 1874 to 1876, are largely without foundation. We shall be able to speak more authoritatively upon this subject after Mr. Bruner's return.

Recent Changes of Location.—Dr. Clarence M. Weed, formerly entomologist and botanist of the Ohio State Experiment Station, has recently been elected to the chair of zoölogy in Dartmouth College, at Hanover, New Hampshire.

Mr. F. M. Webster, a field agent of this Division, who has been stationed for several years past at Lafayette, Indiana, has been transferred to the Ohio Agricultural Experiment Station, at Columbus.

Mr. F. J. Niswander, late assistant in entomology at the Agricultural College of Michigan, has accepted the office of entomologist to the Wyoming Agricultural Experiment Station, at Laramie.

Mr. C. W. Woodworth, formerly of the State Experiment Station at Fayetteville, Arkansas, has lately been appointed entomologist of the experiment station of the University of California, at Berkeley.

Mr. C. P. Gillette, late entomologist at the agricultural experiment station located at Ames, Iowa, has been transferred to the Colorado Experiment Station, at Fort Collins, Colorado.

SOME ICERYA AND VEDALIA NOTES.

As the figures which we have previously published of *Vedalia cardinalis* have not been as perfect as they should have been, owing to the fact that the material first received was poor, we publish herewith more careful drawings made from living specimens. It must be stated that

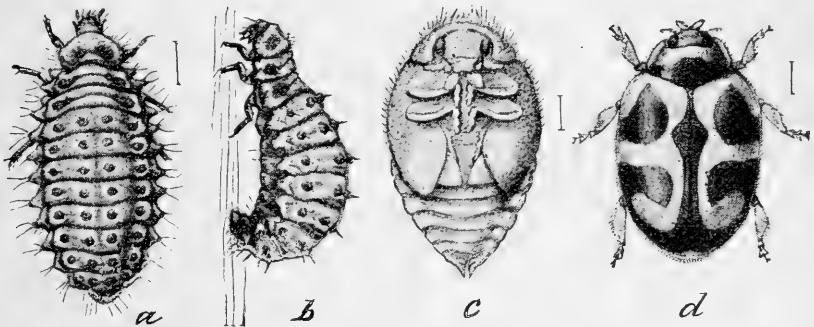


FIG. 31.—*Vedalia cardinalis*: a, larva, dorsal view; b, Larvæ, from side; c, pupa; d, adult—enlarged (original).

while perfectly fresh adults exhibit the markings as plainly as shown at *d*, the majority of those found at work upon the scales are dull in color and more or less indistinct in maculation. We have recently had some international correspondence of interest relative to *Icerya* and *Vedalia*, which we summarize herewith.

On April 9, 1890, the Secretary for Agriculture of Cape Town, South Africa, wrote to the Secretary of the United States Department of Agriculture, stating that *Icerya purchasi* had steadily increased in South

Africa and that it would be a great favor to the fruit-growers of the colony if this Department could send some specimens of *Vedalia cardinalis* to assist in the extermination of the scale. On account of the length of the journey from California to Cape Town, we concluded that it would be best to try the experiment first from either Australia or New Zealand, and accordingly wrote to Mr. R. Allan Wight, of Auckland, and to the late Mr. F. S. Crawford, of Adelaide, enlisting their services in the matter. Unfortunately, however, neither of these gentlemen was able to secure any *Vedalia*, and as a result we were obliged to rely upon California stock. Mr. Coquillett was instructed in May, 1890, to prepare a shipment of beetles, but at that time the insect was very scarce and he was unable to get together enough living specimens to make the attempt worth while. In January, 1891, however, partly through the kindness of the State Board of Horticultural Commissioners, he had secured a large number, and on January 20 sent about 1,000 pupæ and full-grown larvæ, packed in two strong wooden boxes between layers of tissue paper, by Wells, Fargo & Co.'s express. We had a strong hope that some of these specimens would get through alive, but we were informed, under date of April 14, by the South African Secretary for Agriculture, that the insects were on receipt turned over to our friend, Mr. R. Trimen, curator of the South African Museum, who reported that they were probably all dead. He wrote that it was possible that some of the pupæ might still be alive, but we have not yet heard as to the correctness of the surmise. Practically, therefore, this first attempt has been a failure. We have made arrangements, however, to repeat the trial immediately, and have adopted a different method. This time we shall have as large a quantity as possible of the insects placed in perforated tin boxes which have been wrapped with cloth. Mr. Coquillett will go to San Francisco and have them placed on ice on the Australian steamer, and will make arrangements to have them transferred under competent personal supervision to a vessel from Australia to the Cape. If this method is found to be impracticable, they will be sent by way of New York and Liverpool under similar conditions.

We have also made an attempt on a small scale to send *Vedalia* to New Zealand. At first blush this may seem like sending coals to Newcastle, but the fact is that *Icerya* has almost completely disappeared from New Zealand and that *Vedalia* is no longer to be found, or rather was not at the time of the sending, as no effort had been made to artificially preserve the species. We published in our last number, on page 395, a letter from Mr. Wight, in which he incidentally requested us to send a few living specimens to Dr. Locking, president of the Fruit-Grower's Association, at Felson, New Zealand. Such a shipment was sent to Dr. Locking, but resulted unfavorably, seemingly through the fault of the New Zealand customs officials, as the box had been opened and carelessly retied, so that the insects escaped in the mail pouches, where they were found by the postal employés and forwarded to a locality where there was no food for them.

So far, then, there have been four attempts to carry *Vedalia* from one country to another. Those from Australia to California and from California to the Sandwich Islands have been successful, while those just mentioned have been failures. On page 423 of our last number we mentioned our correspondence with Rear-Admiral R. W. Blomfield, R. N., Deputy Commissioner-General of Ports and Light-Houses, Alexandria, Egypt, relative to the Egyptian *Icerya*, which he states threatens to become an eleventh plague. Quite recently (early in July) Mr. Coquillett in accordance with our instructions sent a shipment of *Vedalia* to Alexandria, and we look forward to information as to their receipt and colonization with great interest.

In the meantime, as Admiral Blomfield writes us under date of June 1, an Alexandrian merchant, a Mr. Carver, received a sending from California friends which purported to contain *Vedalia*, and certainly did contain some living Lady-birds. These were liberated under the tent prepared for our consignment. Three weeks later the tree was examined and specimens of a Lady-bird were found, which were sent to us for examination. They were not *Vedalia*, and we are informed that the same species was found free in other portions of the same garden. It resembles *Vedalia* closely in size. Its color is dark brown, with a lighter band across the elytra, so that it is not very unlike the dark and dirty specimens of *Vedalia*, which are in the majority.*

It is worthy of note that Admiral Blomfield's sending contained living and healthy specimens of the Egyptian *Icerya*, which indicates the possibility of a constant food supply for *Vedalia* on long journeys. It is needless to add that we shall not allow the species to spread in this country.

Our anticipated sending of *Vedalia* to the West Indies, for use against the Montserrat *Icerya*, is no longer necessary, as our correspondent, Mr. H. De Courcy Hamilton, has informed us that he has practically exterminated the species by cutting down and burning the infested trees.

EXPERIMENTS WITH A DATE-PALM SCALE.

About July 8, 1890, the Department of Agriculture received from Algiers, Africa, nine Date-Palm trees, two to four feet high after having been cut off at the top, and probably from seven to ten years old from suckers.

*At our request Dr. Geo. H. Horn has made a careful examination of the specimens on account of the interest attaching to them and informs us, since the above was in type, that it is safe to refer the species to *Chilocorus distigma* Klug, found commonly in Abyssinia, Arabia, and Egypt. This renders it tolerably certain that an indigenous Egyptian Lady-bird has learned to prey on *Icerya*.

About the 1st of August, fifty-four small trees of Date Palm were received from Cairo, Egypt, one to two feet high and about three years old from suckers. These trees were all badly infested with a species of *Parlatoria* which proved, on comparison, to be identical with *P. zizyphi* Lucas. As it was the intention of the Department to establish these trees in California, and it was highly undesirable to introduce the scale with them, the entomologist was instructed to take steps to destroy the insects and free the plants. The efforts to do so are of interest in view of the great difficulty experienced in effecting the *complete* extermination of the scales by the use of the insecticide washes which our experience has shown to be so successful against the various introduced and native scale-insects of our orchards.

The difficulty was in part due to some peculiarity of the scales themselves, and also to the fact that they were so thickly massed that the underlying insects were at first not reached by the insecticides. It emphasizes the necessity of abundant caution in all similar cases and the need of the most thorough and intelligent supervision.

The first lot of trees were sprayed about the middle of July and the second lot about the 1st of August with kerosene and soap emulsion diluted fifteen times. August 16 the plants were still, in many places covered with live scales and were all again sprayed with the kerosene emulsion diluted *ten* times. August 18 and 19 examination showed a considerable percentage of seemingly healthy scales. The trees were uninjured. Two test sprayings were then made as follows: Two of the younger lot of trees were sprayed with the resin wash made after Coquillett's formula (see Bulletin No. 22), and two were sprayed with the kerosene emulsion diluted only five times. These trees were examined August 22 and September 2, and the effect of these applications noted as follows: The resin treatment was practically without value and had no injurious effect on the plants; the trees treated with the kerosene were, August 22, somewhat yellowed and injured and the scales were all apparently dead. Later, September 2, the plants had partly regained their normal color and no living scales were found.

On September 5 all the trees were carefully examined, and about 5 per cent of living scales were found, showing that many of the scales at first apparently unaffected by the earlier washings had eventually succumbed.

It was hoped that the remaining living scales had been affected and would die, but examination, September 18, showed about the same percentage of healthy scales and also a few young. The trees were then thoroughly washed with a stiff brush to remove the loosely adhering dead scales and were again sprayed October 4, with a newly made and excellent kerosene and soap emulsion diluted eight times. Continuous rains fell on the 6th and 7th, and on October 8 very few living and apparently healthy scales were found. October 9 the application

of the emulsion in the same proportion was repeated, the rain having vitiated the preceding application. This spraying we believe affected the final and complete extermination of the scales, but as the trees stood these applications without injury, to put the matter of extermination beyond doubt, and as a final precaution, they were again all sprayed, and were shipped October 10.

It will be noted that the earlier sprayings were practically successful⁴ 90 to 95 per cent of the scales eventually dying; but in this instance it was essential that not a single scale should escape or the work would have been valueless, and hence the necessity of the additional treatments. A further outcome of these experiments is the very evident fact that the Date Palm is not apt to be injured even by the application of very strong kerosene washes, repeated at comparatively short intervals.

A VIVIPAROUS COCKROACH.

By C. V. RILEY.

On page 129 of No. 1, vol. II, Proceedings of the Entomological Society of Washington, I have published a short note under the above title, reciting the fact that a female specimen of *Panchlora viridis*, a large green tropical Cockroach, found commonly in South America and the West Indies, had been sent me [September 21, 1890] by Dr. Carl F. Gissler, of Brooklyn, New York. He had found it in Brooklyn alive on a cabbage head, and having put it into a box until the next morning, it was then discovered to have died over night, and that out of its genital orifice had crept some two dozen live young ones. As stated in the note before the Entomological Society, the specimens interested me greatly because, so far as I had been able to ascertain, there is no record of a viviparous Cockroach, and after a careful examination, involving a dissection of the abdomen of the specimen, I saw no reason to doubt the accuracy of Dr. Gissler's statement. Several of the young had already been born as above stated, but still others were in the abdomen ready to emerge, with no trace of either eggs or egg-case.

Mr. S. H. Scudder, who is most familiar with the Orthoptera, as well as with the general literature of entomology, writes in reply to a question, under date of June 6, that he does not recall having seen any similar fact recorded. He has called my attention to the following

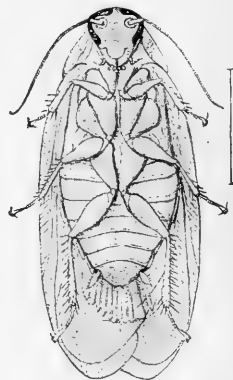


FIG. 32.—*Panchlora viridis*, adult, enlarged (original.)

following note from *Psyche*, vol. v, page 405, August to October, 1890, as referring probably to the same species:

Early last August a green cockroach of considerable size, *Panchlora nivea* (Linn.), was found alive with a multitude of young ones just hatched in the bath-room of a house on Lafayette street, Salem, Massachusetts, and sent to Mr. S. H. Scudder for determination by Prof. E. S. Morse. It is a native of Cuba and Central America. It is curious that Mr. Scudder has also in his collection a specimen marked as found flying in a store in Boston, 26 December, 1878, on the authority of the late Dr. Samuel Kneeland.

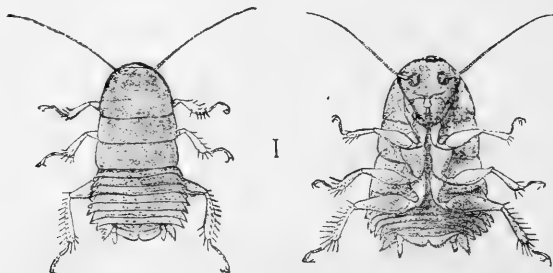


FIG. 33.—*Panchlora viridis*, newly hatched young, from above and from below—enlarged (original).

No mention is made in the above item of the viviparity of the roach, but from the wording and from the fact that no egg-case is mentioned it is altogether likely that the facts were similar to those given by Dr. Gissler in the case which he observed. As stated before the Entomological Society: "The significance of this exceptional fact is that the extrusion of the eggs in a compact oötheca is supposed to be one of the distinguishing features of the family *Blattidae*, and such cases serve to show how difficult it is to lay down any rule in reference to the characteristics of any group that may not involve exceptions. So far as other family characteristics are concerned there is nothing peculiar in this species of *Panchlora*. It is a rather soft-bodied species, with ample wings. I would call attention, however, to the fact that the young have either lost or never had the green color of the parent. They are pale-brownish, and are further peculiar in that the body broadens posteriorly, the abdominal joints being strongly contracted and telescoped into each other, the eighth and ninth so strongly drawn into the seventh as to give the abdomen an unnatural, foreshortened, truncated appearance. Whether this feature is due to the alcohol or is normal it is impossible to say; but there is no evidence of any other portion of the body having shrunk or contracted on account of the preservative liquid."

THE GRASSERIE OF THE SILK-WORM.

By PHILIP WALKER.

The prevalence of grasserie in the United States during 1890, as stated in my last annual report, points to the necessity of further study of the disease and a search for some means for its prevention or cure:

When the sixth edition of Dr. Riley's Manual on Silk Culture, issued by the Department, was prepared, the rarity of the malady led him to refer to its slight importance and the little attention heretofore given it by scientists. In Europe the few worms which are attacked by grasserie are hailed with delight by the raisers, who say, "*Pas de gras, pas de cocons*" (no grasserie, no cocoons). This sentiment is due to the fact that grasserie is seldom accompanied by other diseases, and in itself is rarely disastrous. The only precaution taken with such rare

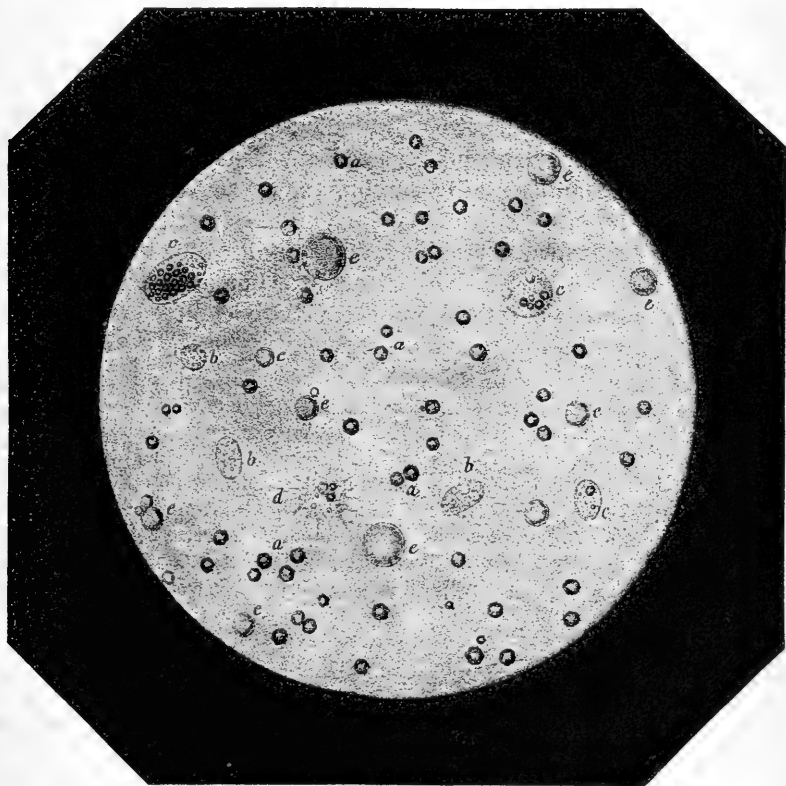


FIG. 34.—Polyhedral granules of the grasserie.
(After Bolle.)

specimens as thus occur is to remove them from the rearing tables for fear that they will soil the other worms or their cocoons. The literature of the subject is therefore small. Pasteur's only reference to the malady

occurs in his including grasserie among the four typical diseases of silk-worms,* and the remark made later on the same page: "Once only have I seen the grasserie destroy a brood." Still it must be remembered that Pasteur knew nothing of silk-worms prior to his studies on the pébrine, and that his observations of silk-raising generally had not been extensive. The disease is known to our silk-raisers under the name of jaundice, but except as applied to the yellow races this is a misnomer, as the white and green varieties turn milky, not yellow, when attacked with the malady. It is to the yellow races that I shall hereafter refer unless otherwise stated.

"The disease makes its appearance when the worms are about to molt and is most severe when it occurs during the fifth age, just at the spinning time. The first signs of the trouble are small pale yellow spots which appear around the stigmata. These spots gradually expand, others appearing on the elevated portions of the rings, until they cover the whole body; at the same time their yellow color becomes deeper. Simultaneously with this discoloration, the anterior rings (often mistaken on account of their shape for the head of the larvæ by persons unacquainted with its anatomy) begin to swell, this being soon followed by the distension of the other rings to such an extent that the interannular spaces appear like strangulations. The stretched skin becomes bright and tender, and finally, unable longer to resist the strain, it bursts, at first at the joints of the rings and later in other places, permitting the discharge of a troubled dirty liquid which soils the food of neighboring worms. The body afterwards putrefies and turns black, more slowly than in flaccidity and all over at once, not beginning near the anterior pair of prolegs, as is the case with the latter disorder."†

When the worm is cut open in the early stages of the disease, that is to say, when the first little yellow spots are discovered about the stigmata, no changes in the internal organs can be seen with the naked eyes, only the blood appears turbid and milky. Henceforth the worm refuses food and crawls about uneasily. In 12 hours or even in less time its whole body has become yellow, and the feeble skin allows the now quite opaque blood to ooze out. The stomach is sometimes full of leaves of a bluish green color, and sometimes contains a more or less transparent liquid, which either wholly or partially fills its cavity. In the latter case vomiting often occurs. In the cæcum or the rectum, or in both, a large brownish mass is found, which is formed of minute particles of leaf.

When the disease is far advanced a careful observer will often find on the peritracheal membranes of the larger tracheæ, on the epithelium of the silk-bearing glands, on the muscles, and even on the nerves, whitish spots which interrupt the transparency of the organ, and which in appearance are similar to the whitish spots of the silk-bearing glands of highly corpulent worms. * * *

If at the beginning of the disease the blood of the worm is examined with a microscope, it is found that the turbidness is caused by very minute *polyhedral granules* floating in the plasma or inclosed in the blood globules (Fig. 1, *a*). These granules are also constantly found in the cells of the adipose tissue, where they gradually increase in number as the disease progresses, until the cells are filled with them to

* *Études sur la Maladie des Vers à soie*, vol. I, p. 225.

† "The Mulberry Silk Worm," Bulletin 9, Division of Entomology, plate I, fig. E.,

repletion. The increase of the granules takes place likewise in the blood, which in the last stage of the disease contains an infinite number of them both in the plasma and in the greater part of the globules.

Other tissues are often invaded by these granules, and also some cells of the peritracheal tissue, together with portions of the epithelium of the silk-bearing glands; the partial accumulation of these granules and their powerful refraction of light are the cause of the whitish specks that are seen with the naked eye on the aforesaid tissues, as has already been remarked. When the disease is far advanced * * * the granules are sometimes deposited under the neurilemma and under the sarcolemma, and under those very parts of the nerves and muscles where the capillary terminations of the tracheæ are found. The membranes of the genital organs and the outer coating of the stomach are also invaded by them. In this stage the intercellular substance of the various tissues seems to lose its connective power, or to be dissolved, since entire cells of the adipose tissue, of the derma, and the tracheal epithelium are then found floating in the blood. The filling up with granules contributes in part to the loosening of the cells, which soon become lacerated and discharge their contents into the blood; thus we find in the blood fat globules (see Fig. 1, e), crystals of urate of ammonium, fragments of cells, and masses of protoplasm.

When the disease has advanced thus far the mortification of parts of the tracheæ and the adipose tissue begins; this may be recognized by the dark spots, similar to those found in a worm affected with the disease known as flaccidity.

The alterations of the anhistous coat of the stomach are deserving of special attention; this coat, in a worm affected with the grasserie, is very much thickened, and is composed, as it is in a flaccid worm, of many superposed strata. If the stomach is partly or entirely empty of leaves the anhistous mass occupies a part or the whole of the cavity, forming a coagulum containing a strongly alkaline liquid, in which micrococci are frequently found, and sometimes also other bacteria, although there is no reason for suspecting a complication with flaccidity. * * *

The anhistous coat continues in the cæcum and in the rectum, where it incloses the minute particles of dark brown leaf, in the shape of large hard masses, of which the worm sometimes succeeds in ridding itself, and then these masses, being inclosed by the anhistous coat, remain attached to the anus. It is not unusual to see worms dragging after them three or four and even more fecal masses attached to each other in the form of a chain. Both in the liquid contents of the stomach and in the excrement large prismatic crystals of ammonium magnesium phosphate are found, together with crystalline concretions of leucine.

According as the disease attacks the worm at a more or less advanced stage of its existence, the renal vessels are more or less cretaceous, yet the opacity or the engorgement with crystals of these vessels does not form a pathological symptom of the grasserie but constitutes a normal physiological phenomenon.

Interesting is the observation that the yellow spots on the skin of a diseased worm are caused by numerous needle-shaped crystals, of a very deep yellow color, which are found in conglomerated masses under the epidermis. These crystals are similar to those found in the renal vessels of worms inclosed in their cocoons, or which have been for a short time in the chrysalis state, and hence are to be considered as produced by respiration.

In cases of very intense grasserie chrysalides affected by the disease are constantly found. Whether the grasserie attacks the worm near its fifth molt, and continues after the molt is ended, or whether the chrysalis itself is attacked by it, the latter never develops into a moth. A chrysalis in the earlier stages of the grasserie presents no external symptoms by which the diseased condition can be recognized. Soon, however, it loses its natural rigidity and becomes flabby; the internal organs are gradually converted into a brown liquid, which gushes out when the slightest lesion takes place. This is the reason why cocoons coming from broods of worms

among which the grasserie prevails in a severe form are contaminated internally, and their silk being impaired, are of less value.

The internal alterations of a chrysalis affected with the grasserie are in all respects identical with those found in the worm, and are principally in the blood, the tracheæ, and the adipose tissue, which contain the characteristic polyhedral granules. It is a noteworthy fact that in some chrysalides that have died of the grasserie, and whose organs are in a state of complete dissolution, the usual organisms of putrefaction, *i. e.*, micrococci and other bacteria, can not be found.

It is known that before setting apart a lot of cocoons for the preparation of seed among the precautions to be taken is that of examining the chrysalis in the cocoon. If dead chrysalides are found, it will be highly important to determine the cause of death. If death has resulted from mechanical lesions, which is rarely the case, the chrysalis will not be dissolved, but will be dried up, preserving here and there the original color of its external covering.

The case is different if the chrysalis has died of flaccidity or of the grasserie, because in both cases the internal organs pass into a state of complete dissolution, and the body becomes black. In these conditions the disease can not always be discovered with the naked eye, and recourse should be had to the microscope. Chrysalides that have died of the grasserie will contain the characteristic polyhedral granules, while those that have died of flaccidity will show the presence of the usual organisms of putrefaction, *viz.* micrococci and other bacteria.

An examination of the symptoms of the grasserie shows that the principal one is the spontaneous formation and multiplication of the polyhedral granules, which successively invade all the tissues in a manner almost analogous to that of the corpuscles of the pébrine. We are not yet, however, in a position to decide whether these granules are to be considered as an effect or as the cause of the disease.*

The polyhedral granules of the grasserie were noticed first by Cornalia,† who, however, did not discover their true form, which Versou‡ determined to be crystalline, usually hexagonal, with very obtuse angles. Bolle, while assistant to Haberlandt, studied their chemical characteristics and the latter announced that they were crystals of *acid urate of ammonium*,§ but Bolle himself in a later article,|| says that he had been in error in his first analysis, and that the urate found had probably come from "the derma of the worm and the adipose tissue of the chrysalis," which existed as impurities in the deposit at first supposed to be entirely composed of granules. The polyhedral granules differ in appearance from the urate crystals found in the organs of the worm and in the fluid excreted by the moth upon its exit from the cocoon only in their size, the former being about 4μ in diameter while the latter range from 0.5μ to 2μ . Certain reactions upon these characteristic granules of grasserie indicate an albuminoid nature, but the fact that they have been retained for a year under water without changing form refutes this supposition.

Forbes¶ speaks of the granules as "evidently the mulberry cells and

* Bolle, *Annuario dell' i. r. Istituto Bacologico Sperimentale di Gorizia*, 1873, pp. 106-114.

† *Monografia del Bombice del Gelso*. 1856, pp. 348-351.

‡ *Del Filugello et del suo allevamento*, p. 141.

§ *Haberlandt, Sericoltura Austriaca*, Anno. IV, No. 7. (April 1, 1872.)

|| *Op. cit.*

¶ Bulletin on the "Contagious Diseases of Insects," p. 279.

granules of Viallanes, as described in his admirable memoir on the histolysis of insects.* He, however, does not discuss their nature, simply speaking of them as the ever present and unmistakable symptom of the disease either in the silkworm or other larvæ upon which he had experimented.† Professor Forbes, however, shows no evidence of having seen the several Italian articles of which I have spoken, but devotes his attention to the bacterial causes of the disease, causes which the European investigators have either overlooked or ignored. Bolle regretted, in the comprehensive article from which I have quoted, that the inaccurate nature of microchemical research prevented his advancing any well supported theory on the exact nature of these globules, though he intended pushing his studies further. I can not find that he published any later article thereon. The tests which he used in endeavoring to determine their chemical composition are such as would be used at this day, so that we need hardly look to any newly discovered chemical processes to aid us in new researches.

For the cause of grasserie as many theories have been advanced as there are writers on the subject. Among those apparently the more reasonable are that it may be caused by a disturbed digestion (Lomeni); by "close, damp heat, accompanied by electrical tension, or by a sudden change in the pressure of the atmosphere" (Maestri); by "damp air and lack of ventilation, light, and cleanliness" (Cornalia); or by the manner of preserving the eggs or the influence of some hereditary predisposition (Haberlandt). Pasqualis calls attention to the fact that had come to his notice that near Venice, where the trees are annually pruned, grasserie is much more common than around Trent, where the food is picked from old wood. He therefore ascribes the trouble to the feeding of too tender leaves. It will be recalled that my report for 1889 mentioned the fact that all of our brood, fed on the tender leaves of a trimmed osage orange hedge, died of grasserie, while the brood fed in the same room, on mulberry leaves picked from old wood, gave such remarkable results as 135 pounds of cocoons per ounce of eggs. The latter showed very few cases of grasserie. I once asked Maillot his opinion of the cause of the disease and he attributed it to too rich food, saying that often a worm just ready to spin would eat an especially rich leaf and be attacked by the disorder. To this phase of the subject I shall recur later.

So far as I can venture an opinion on this subject it seems to me that Professor Forbes has come nearer to the true cause of the disease, which he considers bacterial. He states, however, in his publications on the subject, that he worked under the disadvantage of not seeing the brood of silkworms that had been attacked by the disease, but began his researches on some dead, though fresh, larvæ which had been sent to him by Professor Burrill of the Illinois Industrial Uni-

* Ann. Sci. Nat. Zoöl., XIV, 1, Art. 1, August, 1882.

† Notably the cabbage worm (*Pieris rapæ*).

versity. Besides the usual polyhedral granules of the disease Forbes found several different forms of bacteria. Various cultures made by him convinced him that a spherical micrococcus, varying in diameter from $0.75\ \mu$ to $1\ \mu$ is the characteristic bacterium of the disease. He found it practicable to cultivate this micrococcus artificially in neutralized beef broth by infections from the alimentary canal and from the blood. "Although the micrococcus itself was not demonstrable in the blood by the microscope, it was obtained therefrom by cultures in which it appeared without admixture of other forms. Intestinal cultures were, however, liable to contamination by other bacteria but doubtfully connected with the disease."

The lateness of the season prevented Professor Forbes from trying infection experiments on silkworms and he was obliged to resort to the cabbage worm. He sprayed broods of these with a beef-broth culture of the spherical micrococcus mentioned above, and although the results were not so definite as desired "yet they clearly indicated the transference of the disease affecting the silkworm to healthy larvæ of the *Pieris rapæ*." He sums up as follows :

It would have been difficult to establish, by a study of the bacteria alone, any marked difference between the disease resulting from this experiment and that native to the cabbage worm, but the symptoms of the two diseases are so unlike as to make it impossible to confound them. The general absence of the peculiar discoloration of the common flacherie of the cabbage worm and of the rapid post-mortem deliquescence even more characteristic of it leave no doubt as to the actual difference between this induced disease and the spontaneous affection. That the artificial disease was identical with that of the silkworm, differing only in such a degree as was to be expected when attacking such widely different larvæ, is rendered probable not only by all the attending circumstances but also by the occurrence in the cabbage worm of the myriads of mulberry granules characteristic of the affection in the silkworm. This fact is especially significant, since, in all our numerous examinations of the native flacherie of the cabbage worm, this condition of the fluids was not once observed.

If we acknowledge that this single experiment is conclusive evidence of the bacterial origin of the disease we have an easy explanation of the difference of opinion entertained by Europeans as to the cause of the malady. The characteristic bacteria might well exist in the larvæ, but under conditions so healthy as to prevent their abnormal development. The loss of vitality due to improper preparation or care of the eggs, to bad ventilation or a damp atmosphere, to a sudden change in meteorological conditions, or to impaired digestion owing to improper food, might supply in a moment those conditions necessary to the development of the organism and the appearance of the disease. Such being the facts Haberlandt, in the absence, probably, of the needful micrococcus, failed to induce the grasserie by putting the worms into a cold, damp cellar. Worms raised from eggs laid by moths from an infected brood have died of flaccidity, not grasserie, and attempts to produce contagion by smearing the food with the blood of infected worms have given but negative results.

But how, then, does this bacterial attack cause the disintegration shown by the polyhedral granules? Bolle says:

We suppose that the formation of the polyhedral granules is caused by defective respiration; we are led to this belief by the accumulation of these granules, first in the adipose tissue and then at the capillary terminations of the tracheæ, both of these being parts of the organism whose main function is respiration. Even if this supposition of ours were correct, we are still unacquainted with the prime causes of the spontaneous formation of these granules. It may be regarded as certain that humidity, low temperature, and defective ventilation contribute not a little to the grasserie. But we would say that these influences alone can not develop the disease, although it is probable that they increase its intensity; otherwise we should have no explanation of the sporadic cases of grasserie which are of constant occurrence even among those broods that are most judiciously cared for.

Per contra, I give Forbes's conclusions:

Assuming that the mortality was originally caused by the intestinal bacteria, we may suppose that this infection was not sufficiently overwhelming to destroy life by direct action, as seems to be the case in *flacherie*, but that it nevertheless had the effect to so disturb the balance of physiological functions as to retard the development and preparation for pupation of some of the organs, while the fatty bodies, being special stores of material accumulated for use in pupation, and so less promptly and easily affected by causes attacking the general health of the larva, went on to pupation and experienced the histolysis characteristic of that phenomenon. In other words, we may suppose, quite consistently with all the facts, that a relatively slight bacterial attack took *uneven* effect on the various parts of the animal and not immediately destructive effects on any; that it retarded the preparations for pupation of the great vital organs, but that the fatty bodies, as if unaware of this fact, continued their course of maturation and histolysis, reaching a condition of pupal disorganization before pupation had actually occurred (p. 280).

OBSERVATIONS ON INJURIOUS AND OTHER INSECTS OF ARKANSAS AND TEXAS.

By F. M. WEBSTER.

Acting under Dr. Riley's instructions, I left home on February 2, and stopping a couple of days in southern Indiana to make some observations on strawberry insects, more especially *Haltica ignita*, reached Memphis, Tennessee, on the 5th instant. The object in visiting this locality and eastern Arkansas was to secure some data with respect to the early stages of the several species of Buffalo Gnats. No difficulty was experienced in finding the exact locality, a short distance to the southeast of Memphis, where Dr. Lugger studied *Simulium* in 1886, but the stream was so swollen by recent rains that wading was rendered impossible, and as no boat was obtainable a critical examination was rendered impracticable.

At Madison, Arkansas, where I had studied the habits of various species of *Simulium* during 1887 and 1888, very many larvæ were found in the swiftest flowing portions of the St. Francis River, being attached as usual to young willows and cottonwoods growing in the stream. Some

of these larvæ were very young, or at least exceedingly minute, while others appeared to be fully half grown. No adults or pupæ were to be found.

Here, on February 10, *Phlæotribus liminaris* was observed burrowing under the bark of a peach tree which had died the previous autumn. Some of the adults were only recently emerged from the pupal stage, as was indicated by their lighter color, and larvæ of this or an allied species were abundant under the bark of the same tree.

From Madison I proceeded to Franklin County, to visit Mr. W. J. Alexander, postmaster of Vineland, whose vineyard has for several years been ravaged by the Grape Curculio, *Craponius inequalis* Say. The locality is somewhat isolated, being situated on the top of one of the Ozark Mountains about 25 miles north of the Little Rock and Fort Smith Railway. The soil on these mountain tops is very fertile and appears to be particularly adapted to fruit growing, especially grapes, wild varieties of which grow thickly and luxuriantly all over the mountain tops and sides where there is sufficient soil to support them.

The fruit of these wild grapes is large, luscious, and produces a wine of excellent quality. To grape culture, however, the depredations of the Grape Curculio proves a serious drawback, the pest apparently being more widespread and its ravages more pronounced here than elsewhere in the country, though it does not, so far as I could learn, occur in destructive numbers south of the Arkansas River or even in the vicinity of Fort Smith. For my knowledge of the distribution, however, I am indebted to the people of this section of the State, and the injury to wild grapes in the forest may be much greater than has been observed. The damage to cultivated grapes began to be observable as long ago at least as in 1880, and since that time has steadily increased until it has become almost impossible to secure a crop of fruit without bagging the clusters with small paper sacks.

In Mr. Alexander's vineyard, the only one which I was able to examine, the attack commences about June 1, a wet June being supposed to favor the development of the pest, which continues to work destruction until the fruit has ripened, the earliest attack being noticed along the outer margin nearest the woods. As the insect is known to hibernate in the adult stage, it seemed possible that burning over the ground during winter or early spring might result in the destruction of a large number thus passing the winter months among the leaves and rubbish about the wild vines. The greater portion of two days, February 17 and 18, was spent in sifting the dead leaves and surface soil, under wild vines in the woods, and also about cultivated vines, in the vineyard. About the former were invariably found considerable numbers of *Cercopeus chrysorrhæus*, but none of these were found in siftings from the vineyard, and nowhere did I find the Grape Curculio. Under date of April 14, nearly two months after my visit, Mr. Alexander wrote me as follows:

Some weeks after your departure I gathered some leaves and loose earth in my vineyard, just as I saw you do. This I sifted, putting the siftings in the bright sunshine, and sat watching for about half an hour, when I saw a movement among the siftings which looked suspicious, and securing the bug making it found it to be the pest we were after. Soon after I caught a second.

From Mr. Alexander's observations and my own, it seems that but little aid can be looked for in the direction of burning over the forests, and that little only following late burning in spring. If, as I believe to be the fact, the Grape Curculio passes the winter closely ensconced in the ground about the bases of the grape vines or under the loose flat stones with which the surface of these mountains is thickly strewn, destruction by the agency of fire will prove of little value, and we must look to other means, such as are applicable to the vines, both in the vineyard and to, at least, those wild vines in close proximity thereto. The nature of these means, as well as their effect, can only be determined by careful investigation and experimentation.

While riding over the mountains, on my way to Vineland, an insect flew by my ear, and, though not able to see or capture it, the note it produced was unmistakable, and, although I had not heard it for nearly three years, the evidence was conclusive that *Simulia* of some sort were abroad in this region. On the morning prior to my leaving the locality, cattle, more especially young animals, appeared very restive and uneasy. On examination buffalo gnats were found attacking them in considerable numbers. Climbing down the mountain side and following a small stream to its junction with a larger one, and where the water was dashing over its rocky bed, an abundance of larvæ were found attached to the rocks in the midst of the stream. The gnat season was evidently only just beginning, as very few pupæ were to be found, though they were found in this same locality a few weeks later by a young man in the family of Mr. Alexander. While never becoming sufficiently numerous to kill stock, probably on account of the small size of the stream, there are often enough of the gnats produced to cause much annoyance, especially to young cattle. If common testimony is to be trusted, the Ox Warble Fly, *Hypoderma bovis*, is much more injurious to cattle, as is also the Screw Worm, the larvæ of *Lucilia macellaria*.

Information obtained at Paris, Texas, was to the effect that wheat was in the best of condition, and free from all insect attack. While sweeping over the experimental plats of wheat belonging to the Agricultural Experiment Station, at College Station, Texas, I was surprised to observe *Meromyza americana*, and found all of the earlier stages, except the eggs, in considerable abundance; so much so, in fact, that in future a report of serious injury to wheat through the supposed attack of Hessian Fly, but really due to the *Meromyza*, will not be in the least surprising.

A species of *Thrips*, and also a *Phlæothrips*, were especially abundant in young growing wheat. The larvæ of *Leucania pseudargyria* were

also swept from the same plats. *Calandra oryzae* also appeared in these sweepings, showing that this pest, so abundant and destructive to stored grain all over the South, is to be found abroad in the fields very early in the season. A field of turnips (*ruta-bagas*) which had been left out over winter were thickly populated with *Aphis brassicae*, indicating something as to what the cabbage crop has to overcome in that section. During my short stay at College Station I reared two parasites from this *Aphis*, viz, *Allotria brassicae*, and *Diaeretus* n. sp., both in great abundance. A few days later, in Burnet County, the Red-shouldered Sinoxylon, *Sinoxylon basilare*, was observed in great abundance burrowing into Mesquite, and therefore may be looked upon as one of the future orchard pests of the State.

Among the insects swept from growing wheat at College Station, there appeared, singularly enough, a single female Buffalo Gnat. While this individual might have originated in either Navasota River, to the east, or in the Brazos, to the west, it seemed that, as the latter stream was the nearest, there was a greater probability of finding the earlier stages there. A day was spent in examination of this stream, about 7 miles from where the adult was taken, and, as a result, the driftwood and brush in the swifter flowing portions of the stream were found to harbor numbers of larvæ, with, at this time, a few pupæ. These larvæ closely resembled those found in streams in the neighborhood of the Mississippi River, but I could not learn from people residing in the vicinity that any serious effect on stock had been noticed.

A later and extended examination of the river Pedernalis, in Blanco County, and other tributaries of the Colorado River in Llano and Burnet Counties, as well as the Colorado itself, revealed the fact that all of these streams were populated with great numbers of *Simulium* larvæ, very much resembling those observed in the Ozark Mountains of Arkansas. Here, as in Arkansas, the pupæ were in the minority, though much more numerous than farther north.

In Devil's River, a small tributary of the Rio Grande in southwestern Texas, what seemed very similar larvæ were found in great abundance. There will most likely be two species found here, neither of which is like those described from the Mississippi Valley. The Pecos River, in the western part of the State, I did not examine, but from what could be learned of its nature from ranchmen and others, it will most likely prove to be equally well stocked. Along Devil's River, on March 22, adult *Simulia* were abroad in considerable numbers, some of them being infested by a small, red, water mite, apparently belonging to the genus *Diplodontus*.

"The eternal fitness of things" is most aptly illustrated in these rocky streams of western Texas. If the Mississippi River were to empty its overflow into the upper portions of these streams for a few years, during early spring, we should most assuredly see all stock driven out of the country by Buffalo Gnats. Even if the volume of water were con-

siderably increased for any extended period during February and March, the result would certainly prove fatal to great numbers of stock on adjacent ranches. At the very season when the gnats are the most abundant, the so-called Heel Fly, *Hypoderma lineata*, drives the stock from the mountain sides and cañons to the streams, if any such are near, for protection; and, while under existing conditions they only encounter a few gnats, a greater number caused by other conditions would result in their destruction. Even now the attacks of these *Simulia* must cause stock no little annoyance, but there are few if any cases of fatal results, and whatever tendency gnats may have to "run" stock is placed to the credit of Heel Flies.

AN ENCYRTID WITH SIX-BRANCHED ANTENNÆ.

By WILLIAM H. ASHMEAD.

Species in the group *Encyrtinae* with branched antennæ, until quite recently, were considered anomalous and unique, the first to be discovered in this country being my *Tetracnemus floridanus*, described as early as 1885.* Since then, however, Mr. Howard has added one new genus

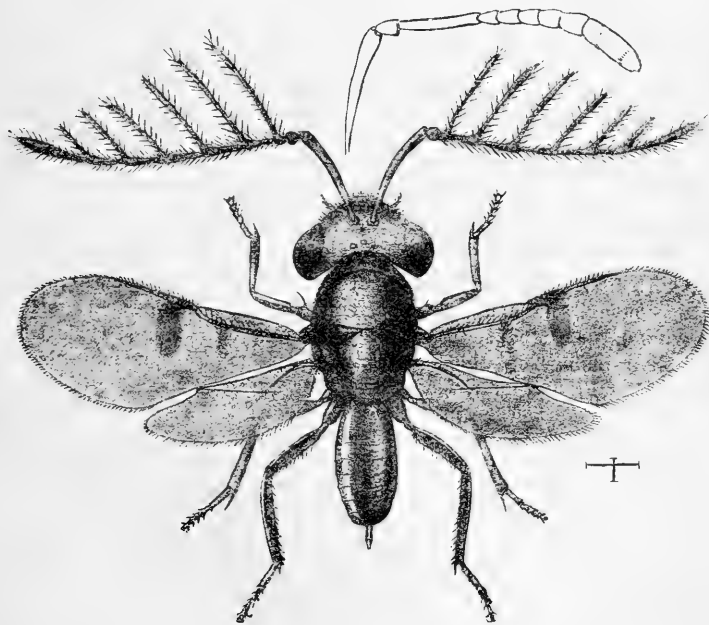


FIG. 35.—*Hexacladia smithii*, male, with female antenna above—greatly enlarged (original.)

and species—*Tanaostigma coursetiae*, from Mexico, and he now informs me he has several new species, representing types of new genera, in the Department collection, which he proposes to describe shortly in a synopsis.

* Proc. Ent. Sec. Acad. N. Sc. Phil., 1885, p. xviii.

On learning from me that I had in my collection a remarkable form from South America, he requested me to draw up a diagnosis of it, so he could incorporate it in his tables, and which I have accordingly done. This Encyrtid, fortunately in both sexes, was discovered in a collection of South American Chalcididae placed in my hands to work up nearly two years ago by that indefatigable collector, Herbert H. Smith, and is only one of several varieties in the collection.

Not alone the six-branched antennae in the male, but the fact that the antennae in both sexes are inserted on the middle of the face make it a unique in the group, as all other described species, so far as I know, have the antennae inserted close to the mouth. The abnormally lengthened first funicular joint in the female is also a remarkable character.

The characters separating this genus from other genera of the Encyrtinae may be derived from the following diagnosis:

Hexacladia gen. nov.

Head very broadly transverse, including the eyes, much wider than the thorax, the face full convex, the space between the eyes and the mandibles longer than the length of the eye. Eye broadly oval, bare. Ocelli three, rather close together and subtriangularly arranged. Labrum very small, transverse, twice as wide as long. Mandibles very small, oblong, truncate at tips, bidentate. Maxillary palpi rather long, five-jointed; labiales short, three-jointed. Antennae in both sexes eleven-jointed, inserted on the middle of the face, the scape long, cylindrical, projected far above the vertex; in the male (Fig. 35) the six funicle joints each furnished with a long hairy ramus, the basal one being the longest, the others gradually diminishing in length to the last; the first funicle joint is very short, the following all long, at least thrice longer than the first; club long, fusiform, three-jointed. In the female the flagellum is subclavate, the first funicle joint being remarkably long, almost as long as the five following joints together; the last five funicles are short and very gradually increase in length and width to the club, the latter composed of three joints. The thorax in the male is strongly developed, highly convex, resembling somewhat an Eucharid; in the female less strongly developed. Mesonotum transverse, smooth, polished, without trace of furrows. Scutellum longer than wide, rounded behind and highly convex. Axillae transverse, convex. Metathorax short, smooth, the spiracles very large, rounded. Middle legs slightly the longest, their tibiae long, slender, cylindric, about one-third longer than the tarsi, the spur more than half the length of the basal tarsal joint, the tarsi stouter than the posterior tarsi, the joints after the first very short. The posterior femora and tibiae are slightly dilated, the tarsi slender, cylindrical, and almost as long as the tibiae.

Abdomen, in both sexes, is small in proportion to the thorax; in the male it is long, oval, composed of seven segments, the first much the longest, the others short, all of about an equal length; in the female it is subcompressed, composed of six segments, the hypopygium being plowshare shaped, the ovipositor slightly exerted; as in the male, the first segment is the longest.

Wings banded; the submarginal attains to the middle of the wing before jointing the costa, the costal cell being somewhat wide; the marginal vein is thickened and a little longer than the stigmal; the stigmal clavate curved upwards; the postmarginal is longer in the male than in the female.

Hexacladia smithii sp. nov.

Male: Length 1.8 millimeters; wing expanse 4 millimeters. Head brownish-yellow, smooth, polished, the vertex fuscous; face very convex, with a few scattered, shallow punctures. Eyes broadly oval, brown. Antennæ black, the scape pale rufous, with a dusky streak above, the six funicular joints each furnished with a long hairy branch. Thorax black, impunctured, highly polished; collar brownish-yellow; scutellum shining, but microscopically shagreened. Anterior legs, including coxæ, brownish-yellow; middle and posterior legs black; in the middle pair the knees, tips of tibiæ, tibial spur, and tarsi are brownish-yellow. Abdomen black, the dorsum concave, probably unnaturally so in the dry specimen. Wings hyaline, with two transverse brown bands that do not extend entirely across the wing, terminating at about its center; the first and narrower is situated at about two-thirds the length of the subcostal vein, the second and broader one just beneath the marginal.

Female: Length 2 millimeters. Head much wider than in the male, and except a streak on the face below the base of the antennæ, entirely black. Antennæ subclavate, brown, the scape and pedicel rufous. Thorax above black, highly polished: the basal half of the scutellum is bright red; collar, mesopleuræ, anterior legs, middle coxæ, tips of middle and posterior tibiæ, and their tarsi, rufous; the rest of the legs dark fuscous. Abdomen short, rather strongly compressed, black, shining. The apical half of the anterior wings, except the margins, is wholly brown, the basal half hyaline, with the narrow subcostal band as in the male.

Described from one ♀ and two ♂ specimens, taken by Mr. Herbert H. Smith, at Chapada, South America, during the month of April, and in honor of whom this beautiful chalcid is named.

HISTORY OF THE HYDROCYANIC ACID GAS TREATMENT FOR SCALE INSECTS.

By D. W. COQUILLETT, *Special Agent*.

So far as I am aware no person ever used hydrocyanic acid gas for the purpose of destroying insects on trees or plants prior to the time that the writer was employed by Professor Riley, Chief of the Division of Entomology, United States Department of Agriculture, in the summer of 1886, to carry on a series of experiments for the destruction of the Fluted or Cottony-cushion scale (*Icerya purchasi* Maskell).

In the month of September of the above-mentioned year I first began experimenting with this gas by confining the trees in an air-tight vessel, and then filling the latter with the gas generated from potassium cyanide and sulphuric acid placed within the vessel. At first I operated on small orange trees, using a common 5-gallon kerosene can, the entire upper end of which had been previously removed. After placing the generator upon the ground at the base of the tree to be operated upon I next placed the necessary chemicals in the generator and immediately covered both the tree and the generator with the tin can inverted over them, the lower edge of the can having been firmly pressed into the earth to prevent the escape of the gas.

I next operated on larger orange trees by using a 40-gallon barrel in the same manner that I had the tin can. After making a series of experiments with this barrel I had a tent made out of unbleached muslin, and afterwards had it oiled with boiled linseed oil; with this tent I could operate on trees about five feet high. I next used a tent belonging to Mr. J. W. Wolfskill, of this city; this tent was made out of heavy ducking, and was large enough to treat trees ten or twelve feet in height. It was simply oiled with boiled linseed oil, and was placed over the trees by the aid of poles. In making these experiments I was aided by Mr. Alexander Craw, Mr. Wolfskill's foreman, and the experiments were made at all hours of the day and also at night.

At first I dissolved the cyanide in cold water, then used it with water but undissolved, and later I used the cyanide dry.

In all of these experiments I used commercial sulphuric acid, undiluted, for the purpose of generating the gas. No machine of any kind was used for the purpose of circulating the gas inside of the tent, and the gas was generated within the tent or other appliance used for inclosing the trees.

Shortly after making these experiments Mr. J. W. Wolfskill had a fumigator constructed for operating on tall trees, and he had the entire upper part of his fumigating tent painted black for the purpose of excluding the rays of light, as my previous experiments with the unpainted tents demonstrated the fact that trees treated in the hottest part of the day were more liable to be injured by the gas when an overdose of it had been used than they were when treated in the cooler portion of the day or at night. In conjunction with Messrs. Wolfskill and Craw I made a large series of experiments with this fumigator both during the daytime and also at night.

All of my experiments with hydrocyanic acid gas, referred to above, were made in the latter part of the year 1886, and they demonstrated the following facts:

(1) That when the aqueous solution of cyanide was used, the trees were more liable to be injured by an overdose of the gas than when the cyanide was used dry.

(2) That trees treated in the hottest part of the day were more liable to be injured by an overdose of the gas than if treated in the cooler portion of the day or at night.

(3) That the use of a black tent in the daytime somewhat prevented injury to the trees by the gas, but only to a comparatively slight degree.

In the spring of the year 1887, Prof. E. W. Hilgard, of the State University of California, delegated one of his assistants, Mr. F. W. Morse, to carry on a series of experiments with various gases for the destruction of insects on Citrus trees, and after testing several different kinds of gases he found none so effectual as hydrocyanic acid gas, which he generated by means of an aqueous solution of potassium cyanide and

sulphuric acid. He also discovered the fact that an overdose of the gas was more liable to injure the tree in the hottest part of the day than it would if used in the cooler portion, and to remedy this he generated carbonic acid gas with the hydrocyanic acid gas; but later experiments made by myself and others proved that this was only a partial prevention. In accordance with the instructions of Professor Hilgard, Mr. Morse used at first a pump, and later a fan-blower, for the purpose of injecting the gas and also of stirring it inside of the tent.

In the latter half of the year 1887 I carried on another series of experiments with hydrocyanic acid gas, using a tent constructed out of common bedticking and oiled with linseed oil. I then for the first time tried the method of passing the gas through sulphuric acid, and found that it was less liable to injure the trees than by either of the methods heretofore used. Shortly after the above facts were published, Mr. Morse also tested this method and reported it as being the most desirable method to use, but recommended using pumice stone saturated with sulphuric acid for passing the gas through, instead of using the liquid acid.

In the summer of 1888, I made another series of experiments with this gas principally for the purpose of testing the different brands of potassium cyanide found in the market of Los Angeles, and found that the cyanide manufactured by Powers & Weightman, of Philadelphia, Pennsylvania, was nearest of a uniform strength, and gave the best results.

In the month of September, 1889, I carried on another series of experiments with this gas, using a tent belonging to Mr. A. D. Bishop, of Orange, California. This tent was made out of blue denims, and before commencing the experiments I had it painted black. All of these experiments were made in the daytime, from 9:30 a. m. to 5:30 p. m., and I found that by using the cyanide dry, along with two parts of water to every one of sulphuric acid, and dispensing altogether with the machinery for circulating the gas in the tent, better results were obtained than by the use of either of the methods described above, while at the same time the process was much simpler and cheaper than these.

After ascertaining the results of these experiments I gave the formula to Mr. A. H. Alward and Mr. A. D. Bishop, and also informed them of the other facts relating to this process, and stated that better results would be obtained by the use of the gas at night than would be by using it in the daytime. Accordingly Mr. Bishop tested this process at night, and finding that it gave such good results he, in conjunction with Drs. W. B. Wall and M. S. Jones, of Tustin City, California, applied for a patent on this process. As soon as I learned that a patent had been applied for I at once wrote to Professor Riley on the subject, and he laid the matter before Assistant Secretary of Agriculture Willits, who wrote to the Commissioner of Patents, protesting against the issuing of a patent on the gas treatment to the above mentioned

applicants, giving a brief history of the case, and the examiner of patents rejected the claims of the would-be patentees. The latter then employed an attorney and sent him to Washington to argue their case before the Commissioner of Patents, and a patent was finally granted to them in the month of January, 1891.

After I had made a large series of experiments with hydrocyanic acid gas several other persons also made a number of experiments with it, but as these have not been made public except in a few instances I am unable to give an account of them in this place; however, these experiments did not contribute to the perfecting of the successful use of this gas, and are therefore of little or no interest except to the persons making them. While carrying on my experiments at Orange in the month of September, 1889, as detailed above, Mr. Bishop informed me that he and Dr. Wall had made some experiments with this gas, these experiments dating from the autumn of 1887. He also informed me that they had obtained the best results by using the cyanide dissolved in water, and diluting the sulphuric acid with water prior to making the tests; but a number of these experiments which I repeated under his direction did not produce the same results that he reported having obtained by them. Mr. A. H. Alward, of Orange, informed me that he had also tried the diluted acid but had not obtained as good results as when he had used the pure acid.

SOME OF THE BRED PARASITIC HYMENOPTERA IN THE NATIONAL COLLECTION.

(Continued from p. 158.)

Family **ICHNEUMONIDÆ**.

Subfamily **Tryphoninæ**.

<i>Parasites.</i>	<i>Hosts.</i>
<i>Bassus agilis</i> Cr	<i>Syrphid</i> puparium. June 14, 1884.
<i>Bassus sycophanta</i> Walsh.....	Gall on oak (<i>Q. obtusiloba</i>). Apr. 25, 1870.
<i>Bassus scutellatus</i> Cr	<i>Leucania unipuncta</i> , seemingly ovipositing on. Huntsville, Ala., May 11, 1882.
<i>Bassus syrphicola</i> Ashm	<i>Syrphid</i> with Rose Aphides. San Francisco, Cal., Apr. 29, 1881.
	Collected, Los Angeles Co., Cal.
<i>Bassus orbitalis</i> Ashm	<i>Syrphus</i> larva on Cabbage, ovipositing on. Alameda Co., Cal., Aug.
<i>Bassus xanthopsis</i> Ashm.....	<i>Syrphus</i> feeding on <i>Aphis brassicæ</i> L. Alameda Co., Cal., Nov.
<i>Bassus eurae</i> Ashm	Saw-fly (<i>Euura</i> sp.?) on Willow. Placer Co., Cal.
<i>Bassus maculifrons</i> Cr	<i>Syrphus</i> on Orange. Los Angeles Co., Cal. Collected ovipositing on <i>Syrphus</i> larva feeding on Cabbage Aphids. Alameda Co., Cal., Oct.

Parasites.

Hosts.

Mesoleptus sp.....	Elm leaf-roller. Kirkwood, Mo. (?), March 13, 1882.
Mesoleius schizoceri, Riley and Howard...	<i>Schizocera ebena</i> Norton. Ocean Springs, Miss, Aug. 19 and Sept. 28, 1887.
Exochus lævis Cr.....	Pyralid larva on <i>Alnus serrulata</i> . Washington, D. C., Feb. 6, 1884. Tortricid leaf gall on <i>Solidago lanceolata</i> . Washington, D. C., June 6, 1889.
Exochus evectus Cr.....	<i>Bucculatrix</i> sp. on <i>Solidago</i> . Kirkwood, Mo., May 16, 1885. Collected also in Texas.
Exochus annulicrus Walsh.....	<i>Tortrix rileyana</i> Grote. <i>Tortrix</i> sp. Kirkwood, Mo., Oct. 18, 1881. Leaf-roller, Lansing, Mich., July 2, 1885.
Exochus fulvipes Cr.....	<i>Tortrix rileyana</i> Grote. St. Louis, Mo., June, 1868.
Exochus albifrons Cr.	<i>Tortrix rileyana</i> Grote. St. Louis, Mo., June, 1868.
Hyperacmus tineæ Riley MS	<i>Tinea pelliionella</i> L. Adrian, Mich., June 17, 1885.

Subfamily Pimplinæ.

Ephialtes irritator Fabr.....	Cerambycid under bark of Oak.
Ephialtes pygmaeus Walsh	<i>Gelechia gallæsolidaginis</i> Riley. St. Louis, Mo., 1867.
Pimpla pterophori Ashm	<i>Pterophorus</i> in stems of <i>Baccharis pilularis</i> . Los Angeles Co., Cal., May.
Pimpla annulipes Brullé	<i>Carpocapsa pomonella</i> Linn. Kirkwood and other parts of Missouri from 1869 on. Alameda Co., Cal., Aug. 15, 1887. Collected also in Mich., Texas, and Washington, D. C. <i>Phycita nebulo</i> Walsh.* <i>Papilio ajax</i> Linn.* <i>Datana ministra</i> Drury.* <i>Tortrix quercifolia</i> Fitch.* Leaf-roller on Strawberry (not reared).* <i>Teras oxycoccana</i> Pack.* <i>Heterocampa marthesia</i> Cram.* <i>Gelechia gallæ-asterella</i> Killicott.* Chilo, near <i>oryzaellus</i> , reared from twigs of Sumach. Washington, D. C.*
Pimpla rufopectus Cr.....	Spider eggs. Alameda Co., Cal., June 10, 1887.
Pimpla pterelas Say.....	<i>Padisca scudderiana</i> Clem. Washington, D. C., ? May 10, 1889. <i>Gelechia gallæsolidaginis</i> Riley. Collected also in Texas.
Pimpla novita Cr.....	<i>Grapholitha olivaceana</i> Riley. Washington, D. C., Apr. 16, 1884. <i>Thalpochares carmelitæ</i> Morr. Bluffton, S. C., Feb. 4, 1890.
Pimpla indagatrix Walsh	<i>Tortrix incertana</i> Clem. on Oak. Kirkwood, Mo., Nov. 7, 1878. <i>Coleophora cinerella?</i> Clem. on Alnus. Washington, D. C., Apr. 10, 1884.

* See INSECT LIFE, vol. II, p. 161.

<i>Parasites.</i>	<i>Hosts.</i>
<i>Pimpla conquisitor</i> Say	Tortricid on cedar. Tiger Mills, Tex., June 21, 1889. <i>Thyridopteryx ephemeraeformis</i> Haw. Camden, N. J., May 24, 1888; Washington, D. C., Nov. 2-7, 1882; April 14, 1883. <i>Aletia xyliua</i> Say Hb. Holly Springs Miss., 1880; Athens, Ga., Nov. 8, 1887; bred at Kirkwood Mo., Feb. 19, 1879. <i>Phryganidea californica</i> Pack. Alameda Co., Cal., June, 1885. <i>Orgyia leucostigma</i> Abb. & Sm. on Willow. Newark, Del., March, 1890. Collected also in Texas and Wisconsin. <i>Phacellura hyalinitalis</i> Linn.* <i>Phycis indiginella</i> Zeller (<i>nebulo</i>). <i>Clisiocampa americana</i> Harr.*
<i>Pimpla inquisitor</i> Say	<i>Clisiocampa californica</i> Pack. Los Angeles, Cal. <i>Orgyia leucostigma</i> Abb. & Sm. Illinois, 1867-'68; Washington, D. C., Apr. 14, 1883. <i>Phycita juglandis</i> Le Baron. Ithaca, N. Y., July 1, 1890. Tineid sp. on <i>Symphoricarpus mollis</i> Nutt. Alameda Co., Cal., June, 1887. Collected also in Missouri, Texas, and Iowa. <i>Gelechia gallæ-solidaginis</i> Riley.* <i>Semasia olivaceana</i> Riley.* <i>Coleophora cinerella</i> Riley.* Leaf-roller on Ash (not reared).*
<i>Pimpla scriptifrons</i> Walk.	<i>Epeira riparia</i> Hentz (egg sac). Washington, D. C., Apr. 1889. Collected in Missouri also.
<i>Pimpla notanda</i> Cr.	<i>Gelechia gallæ-solidaginis</i> Riley. St. Louis, Mo., Apr. 1867. <i>Gelechia</i> (<i>G. gallæ-solidaginis</i> ?) Riley on, <i>Solidago lanceolata</i> . Washington, D. C. Sept. 21, 1883; on <i>S. sempervirens</i> . Atlantic City, N. J., Sept. 14, 1886. <i>Gelechia gallæ-astrella</i> Kell. St. Louis, Mo., May 16, 1873; on <i>Solidago oricoides</i> . Maryland and Virginia, Sept. 5-18, 1883. <i>Papilio troilus</i> L. St. Louis, Mo., Sept. 1, 1873. Issued from stem of <i>Yucca</i> ? Washington, D. C., ? July 3, 1882. Probably on <i>Prodoxus decipiens</i> . Riley. Lepidopterous gall on <i>Baccharis pilularis</i> . San Francisco, Cal., June 30, 1887. Collected also in Texas. <i>Proteoteras asculana</i> Riley.* Leaf-roller on Locust (not reared).*
<i>Pimpla orgyiæ</i> Riley, MS.	<i>Orgyia</i> sp. on Live Oak and other plants. Alameda Co., Cal., July 4, 1885.

* See INSECT LIFE, vol. II, page 161.

<i>Parasites.</i>	<i>Hosts.</i>
<i>Pimpla</i> sp	Spider eggs. Japan.
<i>Pimpla gossypii</i> Ashm.....	Cotton Boll Tortrix. Selma, Ala., Mar. 7, 1879.
<i>Pimpla xanthothorax</i> Ashm.....	<i>Euura</i> s.? <i>nodus</i> Walsh on Willow. Kirkwood, Mo., Feb. 24, 1872.
<i>Pimpla aplopappi</i> Ashm.....	Lepidopterous gall on <i>Aplopappus squarrosa</i> . Los Angeles, Cal. Collected also in Wisconsin.
<i>Pimpla</i> sp.....	<i>Rhopobota</i> (<i>Anchylopera</i>) <i>vacciniana</i> Pack. Bordentown, N. J., June 20, 1878.
<i>Pimpla euurae</i> Ashm.....	<i>Euura</i> on <i>Salix californica</i> . California, Sept. 9, 1885.
<i>Pimpla lithocolletidis</i> Ashm.....	<i>Lithocolletis</i> sp. on <i>Grindelia robusta</i> . Alameda Co., Cal.
<i>Pimpla bicarinata</i> Riley MS	<i>Apatela oblongata</i> Abb. & Sm. St. Louis, Mo., April, 1868, and Champaign, Ill.
<i>Clistopyga pleuralis</i> Ashm.....	<i>Gelechia robiniaefoliella</i> ? Chamb. Kirkwood, Mo., Apr. 5, 1873.
<i>Glypta leucozonata</i> Ashm	<i>Grapholitha interstinctana</i> Clem. Kirkwood, Mo., July 12, 1887.
<i>Glypta xanthozonata</i> Ashm.....	Tortricid on Oak. Kirkwood, Mo., Oct. 15, 1881.
<i>Glypta mellithorax</i> Riley MS	<i>Tineid</i> on Apple. June 11, 1885.
<i>Glypta simplicipes</i> Cr	<i>Tortrix</i> folding leaves of Gooseberry. St. Louis, Mo., July 29 and Aug. 4, 1876. <i>Cacaccia rosaceana</i> Harr. Waukon, Iowa, June 25, 1874. <i>Tortrix cinderella</i> ? Riley, on Apple. Oskaloosa, Iowa, June 12, 1877. <i>Notodonta ulmi</i> Harr. Missouri, Mar. 11-18, 1881. Collected also in Texas.
<i>Glypta rubripes</i> Cr	<i>Eccopsis footiana</i> Fernald. Missouri? June 7, 1886. Collected also at Cadet, Mo., and Veta Pass, Colo.
<i>Glypta erratica</i> Cr	Lepid. stem-borer in <i>Eupatorium</i> . Kirkwood, Mo., Apr. 4, 1884.
<i>Glypta macra</i> Cr.....	<i>Padisca</i> sp. in flowers of <i>Grindelia robusta</i> . Alameda Co., Cal., Feb., Apr., 1888.
<i>Glypta varipes</i> Cr.....	Phycita on Hickory. Kirkwood, Mo., Oct. 18, 1881. Collected also in Texas.
<i>Glypta animosa</i> Cr.....	<i>Padisca scudderiana</i> Clem. Washington, D. C. ? Mar. 16, 1887. Tortricid in stem of weed. Virginia, Mar. 1, 1882. Pyralid on Ailanthus. Washington, D. C., Mar. 17, 1882. Tortricid on Cedar. Tiger Mills, Tex. June 21, 1889.
<i>Glypta monita</i> Cr.....	<i>Gelechia juncidella</i> Clem. Washington, D. C. ? Aug. 2, 1885; June 14, 1886; Sept. 20, 1887. Collected also in Texas.

<i>Parasites.</i>	<i>Hosts.</i>
<i>Glypta rufiscutellaris</i> Cr.....	<i>Proctoteras asculana</i> Riley. Kirkwood, Mo., July 23, 1883, and West Point, Nebr., June, 1885-'86. Collected also in Texas.
<i>Glypta seitula</i> Cr	Tineid on Apple. Washington, D. C., June 10, 1885.
<i>Glypta vulgaris</i> Cr.....	<i>Gelechia</i> sp. Aug. 8, 1886. <i>Margarodes quadristigmatis</i> Guen. Wash- ington, D. C., Aug. 2, 1886.
<i>Glypta militaris</i> Cr	<i>Proctoteras asculana</i> Riley. June 20, 1888. Collected also in Texas.
<i>Glypta</i> sp	Cocoon on Red Cedar. Lafayette, Ind.
<i>Polysphincta phycitis</i> Riley.....	<i>Acrobasis (Phycita) nebulo</i> Walsh. Paxton, Ind., July 21, 1885.
<i>Lampronota frigida</i> Cr	<i>Crambus vulgivagellus</i> Clem. Watertown, N. Y., Nov., (?) 1882. Saw-fly (<i>Messa</i> ?) on Wheat. Indiana, May 21, 1885.
<i>Lampronota occidentalis</i> Cr	Lepid. gall on <i>Baccharis pilularis</i> . San Luis, Obispo Co., Cal., Feb., 1887. Collected also in Texas.
<i>Lampronota succincta</i> Cr.....	Oak gall. Missouri, Feb. 14, 1871.
<i>Lampronota purva</i> Cr	Lepid. Rose-leaf roller. St. Louis, Mo. June 6, 1871. Collected also in Washington, D. C.
<i>Lampronota rufipes</i> Cr	Tortricid Leaf-roller on <i>Solidago</i> . Virginia, July 11, 1884. Collected also in Michigan, Texas, Mis- souri, North Carolina, and California.
<i>Lampronota pleuralis</i> Cr	<i>Tortrix incertana</i> Clem. St. Louis, Mo., Nov. 7, 1878.
<i>Lampronota brunnea</i> Cr.....	<i>Caloptenus spretus</i> ? Thos. Prof. Aughey.
<i>Meniscus elegans</i> Cr.....	Tortricid on Cottonwood. Belleville, Ill., May 5, 1870. Noctuid larva. July 2, 1886. Received also from South Carolina.
<i>Meniscus scutellaris</i> Cr.....	<i>Gelechia pseudacaciella</i> Chamb. on Locust. St. Louis, Mo., Oct. 7, 1872, and April, 1873.
<i>Meniscus dakrumæ</i> Riley, MS.....	<i>Dakrumba coccidivora</i> Comst. ? feeding on Lecanium on Rose. Alameda, Cal., Mar. 1, 1886.
<i>Phytodietus pleuralis</i> Cr.....	<i>Eudemis botrana</i> Schiff. on Tulip tree. Washington, D. C., March 5, 1880.
<i>Phytodietus vulgaris</i> Cr.....	Geometer on <i>Physalis viscosa</i> . Kirkwood, Mo., May 15, 1885. Received also from Texas.
<i>Labena apicalis</i> Cr.....	<i>Chrysobothris femorata</i> Fab. St. Louis, Mo., June 30, 1875. Collected also in District of Columbia and Texas.

Family Trigonaliidæ.

<i>Trigonalys costalis</i> Cr	<i>Acronycta lobeliæ</i> Guen. on Oak. Wash- ington, D. C., Apr. 2, 1885.
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DESCRIPTION OF A NEW TORTRICID FROM CALIFORNIA.

By LORD WALSLINGHAM.

SEMASIA Stph.**Semasia bucephaloides.** sp. n.*Antennæ*, grayish.*Palpi*, stout, projecting more than the length of the head beyond it; grayish-white, sprinkled, especially at the sides, with gray scales.*Head*, grayish-white, sprinkled, especially at the sides, with gray scales.*Thorax*, grayish-white above, brownish-ochreous at the sides.*Fore-wings*, grayish-white, much suffused and sprinkled with gray scales; a brownish-ochreous, elongate, ill-defined patch, extending from the basal fourth to beyond the middle of the wing, parallel to the costa, along the upper edge of the cell; at one-third from the base, scarcely attaining the dorsal margin, but crossing the fold, is a patch of scattered, dark umber scales on a brownish-ochreous ground; a similar patch, but less conspicuous, is situated immediately above the anal angle, bordering the edge of the ocelloid patch; this is whitish-ochreous, shaded around its edges with brownish-ochreous scales, and containing two short longitudinal streaks of dark umber scales on its upper half; above the ocelloid patch the apical portion of the wing is also whitish-ochreous, suffused with brownish-ochreous; the only other marking noticeable, with the exception of some gray mottlings on the costa, is a small whitish patch about the end of the cell, followed by some pale brownish-ochreous scales; cilia, white along their middle, irregularly bordered and interrupted with gray and brownish-gray.*Hind-wings*, very pale brownish ochreous; cilia, white, with a reduplicated grayish line along the base and another at their ends.*Abdomen*, dull grayish.*Legs*, anterior pair whitish, speckled with gray on their inner side; tarsi and tibiæ annulated with gray; posterior pair with the tibiæ and tarsi speckled with pale gray on the outer side.*Exp: al:* 30mm.*Hab:* Little Shasta, Siskiyou County, Cal., September, 1871.*Type* ♀ *Mus. Wlsm.*

EXTRACTS FROM CORRESPONDENCE.

Experiments with Bacterial Cultures against Insects.

I send you to-day specimens of diseased larvæ of *Plusia*. For several weeks I have been investigating the bacterial trouble and find it easily communicable by spraying, and that healthy worms fed on leaves sprayed with exceedingly dilute culture rapidly die.

It occurs to me that there is a chance to save our second-crop (February, March, April) cabbage by spraying the first brood of worms (December, January) with culture solution of this bacterium. The culture could be sent to large growers in December, with directions, using a Vermorel nozzle and Knapsack pump. Perhaps by colonizing worms planting of May 10 and spraying them these spots would prove centers of infection.

I am now trying the spray upon the "Horn worm of Tobacco" and the "Diamond back" worm, and as soon as I can do so shall try the Cotton Caterpillar. I do hope that this will prove a discovery of practical value, for the cabbage crop here is very large.—[J. C. Neal, Florida Experimental Station, Lake City, Florida, May 21, 1891.

Correspondence from Indian Territory.

Inclosed you will find an Hemipteron, which comes out at night, and, like the bed-bug, makes itself too familiar. It is not at all pleasant to have such a bed-fellow, but he will come out regularly to get his fill of blood. He will suck himself so full of blood that he can hardly navigate. What is his name, and is this a normal habit?

Do galls produced by gnats often appear in numbers sufficient to cause damage? There are two pecan trees in my yard and there is not a single leaf on them that is not unshapely with those galls.

Garden insects are scarce so far, but potato beetles are here, though not many so far as I have seen. I send a beetle and an Orthopteron for identification. I found about 200 of the crickets in a butt of a hollow tree.—[A. N. Caudell, Ringo, Indian Territory, May 29, 1891.]

REPLY.— * * * The specimens which you sent came in good condition. The bug whose bite you describe is the so-called Bloodsucking Cone-nose (*Conorhinus sanguisuga*). I shall be glad to have an account from you of your experience with this insect, giving the exact facts. You will find it mentioned in INSECT LIFE, vol. II, p. 106, where a figure is also given. The Orthopterous insect found in the hollow tree is *Phalangopsis cupidicola* and the beetle is known as *Silpha noreboracensis*. The galls upon your pecan trees are not caused by "gnats," but by some plant-louse of the genus *Phylloxera*. They seldom do serious damage to the trees.—[June 8, 1891.]

Notes on three Noxious Insects of Mississippi.

Texas Screw-worm (*Lucilia macellaria* Fabr.). The larva of this fly has been very troublesome in this locality the past year. Have found them on horses, cattle, sheep, and hogs, doing considerable damage. There has been one case reported where the fly oviposited on a human being, a boy about eleven years old, while asleep. Chloroform and carbolic acid are the best remedies we have tried against them. There has been a great deal of excitement about the worm in this county, this being its first appearance to my knowledge since settling here in 1869.

Ox Warble Fly (*Hypoderma bovis* DeGeer.). Have found them in great numbers on the backs of cattle, especially work-oxen and milch-cows. Farmers generally apply spirits of turpentine or kerosene to kill larvæ. They have been very troublesome the past season in this locality. Have recommended to my neighbors an ointment made of sulphur and lard, which closes the breathing pores of the maggot, causing it to die.

Harlequin cabbage bug (*Murgantia histrionica* Hahn.) This has been the first season that I have observed this bug in the gardens of this vicinity. They have been very destructive to the entire cabbage family. I stopped their ravages by hand-picking several times.—[Geo. H. Kent, Roxie, Mississippi, February 7, 1891.]

Sure Way to Destroy Nests of Harvesting Ants.

These insects, often so troublesome in gardens and stock-yards, may be destroyed by the following method: Enlarge the entrance so that it will hold a teaspoonful of London purple, repeat the dose after two days, and if necessary a third time. That is all. I have killed fifty nests, most of them after the second dose, but do not forget to repeat the dose. I have tried cyanide of potassium, etc., in vain, at a much greater expense and with much more trouble.—[F. G. S., Blanco County, Texas.]

Willow Hedges Injured by Saw-flies.

* * * I send you some cuttings of willow containing larvæ. The same were found in willow hedges serving purpose of fence. Many of the shoots are affected, fully 10 per cent, I should judge. Found some while pruning on the 18th instant. Do you know anything about the insect?—[F. H. Stadtmueller, Elmwood, Connecticut, April 20, 1891.]

REPLY.—* * * The willow cuttings containing larvæ which you sent were placed aside and the adult insect was reared almost immediately. It is one of the gall-making Saw-flies of the genus *Euura* and seems to be a new species. It probably makes galls upon the leaves during the summer, and has entered the twigs simply to hibernate. The best remedy will consist in pruning and burning the affected twigs during winter or in removing during summer all leaves affected with galls. This will be a serious labor, but you can determine whether it will be worth while.—[April 28, 1891.]

Oak Furniture Damaged by Borers.

Having recently seen some nicely finished suites of furniture which have been damaged by a borer of some sort, I wish to ask for information as to the name and habits of the insect.

The wood is red oak, white oak, and chestnut oak, and in the last case noticed the furniture had not been finished more than a year, perhaps. As there are many very elegant and costly pieces of furniture now being made of oak it will soon be an important matter to know how to avoid the worm. It seems to *come out* of the wood, as if the egg had been deposited long before the tree was cut. Again, I am puzzled to know how the egg or larva can stand the heat of the dry kiln without losing its vitality. If the oak is specially liable to the attack of such insects it is a rather risky venture to invest in costly furniture or cabinet work when made in that wood.

If furniture is known to be infested already, is there any way to stop the destruction already begun?—[T. C. Harris, Curator State Museum, Raleigh, North Carolina, May 6, 1891.]

REPLY.—There are various species of insects belonging to different orders that are known to injure oak furniture in the manner you describe, but since you do not give particulars as to the appearance and size of the worm which emerged from the furniture it is impossible to tell to what particular species it belongs.

The borers which are most frequently found in furniture belong to the following families of the order Coleoptera: *Cerambycidae*, or Longicorn Beetles, the larvæ of which are known as round-headed borers; *Buprestidae*, the larvæ of which are termed flat-headed borers; *Scolytidae*, and, finally, *Ptinidae*, the larvæ of which have no particular name. The two families last named are mostly small insects, and if their larvæ or imago emerge from a piece of furniture the damage is usually not very noticeable. Moreover, the *Ptinidae* only attack old furniture or perfectly dry timber. Your worm, which presumably was of larger size, belongs, therefore, in all probability, to the *Buprestidae* or *Cerambycidae*. The species of these families rarely, if ever, oviposit in perfectly healthy and living trees, but at once infest trees if they are felled. If the trees after being felled are allowed to remain in the woods for weeks or months during spring or summer the wood is sure to be infested with the larvæ of one or several species of these beetles, and herein lies the chief if not the only cause of the injury to furniture. After such trees have been sawed into boards the larvæ continue to live therein, and if they happen to be in the center of a board no amount of heat of an ordinary kiln will hurt them in the least. If the felled trees at or before the opening of spring be removed from the woods and placed in large, airy sheds they would be protected from the attacks of the beetles, and this is the best and most rational way of preventing injury to furniture. It is also recommended to carefully inspect the boards before they are worked up. In most cases it will be possible to detect the holes of the borers, and the latter can be killed by injecting a quantity of benzine, kerosene, or bisulphide of carbon into the holes.

In the dry wood of furniture the development of these borers is often greatly retarded, and there are instances on record where after the lapse of ten or more years the larvæ or the imago emerge from the wood.

It can be said that the oak harbors a greater number of borers than other trees, and there are few, if any, kinds of trees which are not infested by one or several species of wood-boring insects.—[May 8, 1891.]

The White Pine Weevil.

I am growing some acres of white pine trees (*Pinus strobus*). Their worst enemy is an insect which lays its eggs at the base of the runner, or upright sprig, which starts from the tree's top in the spring. The worm kills this runner and the side shoots then grow in a more upright position and make a crooked tree of little or no value for timber. I see no way to prevent the ravages of this little do-evil, but should like to know more about him.—[J. D. Lyman, Exeter, New Hampshire, April 22, 1891.]

REPLY.— * * * The insect which you complain of is the White-pine Weevil (*Pissodes strobi*). You will find this insect treated at some length on pages 734 to 741 of the Fifth Report of the U. S. Entomological Commission a copy of which I have sent you by accompanying mail.—[April 22, 1891.]

A Lampyrid infested with Mites.

I send a little Lampyrid, which seems to have mites on it. Does the larva live in the ground? I took a thousand from an old pine root. Every morning there would be a lot of them seemingly just come from the root that is in the ground.—[Mrs. A. E. Bush, San José, California, April 24, 1891.]

REPLY.— * * * The Lampyrid beetle is *Eros hamatus*. The larvæ of these beetles live at or near the surface of the ground, often in connection with decayed wood. The mites which you mention on the beetles are the young of some Gamasid and are new to the collection.—[May 4, 1891.]

Diabrotica injuring Corn in California.

Found yesterday what I take to be the larvæ of *Diabrotica soror* very injurious to young corn, which is cut very often entirely off above roots; often three to five larvæ in one plant. Have you had it? Will raise mature insects of same. * * * — [Albert Koebele, Alameda, California, May 25, 1891.]

REPLY.— * * * I am glad to receive the larvæ which are undoubtedly those of *Diabrotica soror*, as we did not have them before in the collection. It is interesting to know that this insect has the same habit as its eastern congeners, *D. vittata* and *D. longicornis*. I shall be glad to have you make full notes concerning its injuries.—[June 2, 1891.]

A new Pest to Prune trees.

I inclose sample of bugs which are eating the foliage of prune trees, stripping them in a short time. What is it? What will kill it?—[J. H. Albert, Salem, Oregon, May 12, 1891.]

REPLY.— * * * This beetle is one of the weevils known as *Thricolepis inornata*. It is a western species and little or nothing is known of its habits. It is a new pest and requires investigation. Feeding as it does, the best remedy will be to spray the affected trees with Paris green or London purple in the proportion of 1 pound to 200 gallons of water. I would urge you to keep this office posted as to further developments.—[May 19, 1891.]

The Pear-blight Beetle and Plum Plant-louse.

I send you two specimens of insects; one of them is on plum leaves and is the smaller and of a greenish color. It is very destructive on the plum. The black and larger insect is at work on the apple trees. They are very numerous and are working on the new shoots where they branch out from the limbs this spring. What are the names of these insects and what are the best remedies for their destruction?—[Jesse P. Elliott, Connorsville, Indiana, May 18, 1891.]

REPLY.— The small green insect on your plums is one of the plum plant-lice, known as *Phorodon mahaleb*. The best remedy for this insect would be to spray your trees with a dilute kerosene emulsion, made according to the formula given in Circular No. 1, New Series, of the Division of Entomology. The other insect is the so-called Pear-blight Beetle (an erroneous designation, as it has nothing to do with the pear blight), known scientifically as *Scolytus rugulosus*. This insect is a very difficult pest to fight, and there are no direct remedies of a practical value. Although the beetle feeds, as you describe, upon healthy trees, it breeds only in trees which are diseased or dying from some other cause. The best preventive, therefore, is a trapping system. If there are any dead or dying trees in your orchard these should be cut down and burned, from the 1st to the middle of June, after the beetles have laid their eggs. In this way you will greatly lessen the number of next year's crop of beetles. If your orchard is large and you have one or two old worthless trees I would advise you to girdle them this summer and burn them entirely next year, about the first week in June. The great majority of the beetles will be attracted to these trees and will lay their eggs in them, which will thus be destroyed.—[June 3, 1891.]

Caterpillars and Spiders migrating in Midwinter.

I send you by to-day's mail a box containing some larvæ and spiders found to-day. They were all traveling upon the ice in an easterly direction. I should like to know how larvæ as lively as these can subsist at this season of the year. The ground has been covered with snow and ice for the last two months, and the place where they were found was covered with a sheet of ice about three inches thick. There were a few hardhacks and bulrushes sticking up here and there, but these could not have furnished food for the worms, since they were dried up. While cutting white birches a few days ago, I noticed that they were thickly covered with *Mytilaspis pomorum*, but not quite as thickly as the piece of apple wood you will find in the box. The scales on the birch seemed more numerous within a foot or two of the ground than elsewhere on the trees. Is this scale of common occurrence on birch?—[John D. Lyons, Monticello, New York, January 16, 1891.]

REPLY.—The larva is the so-called Bronzy Cut-worm (*Nephelodes violans*). The insect hibernates in the larval state, and you will find a precisely similar instance to this you describe, mentioned in the Fourth Report of the New York State Entomologist (Albany, 1883), page 56. Why the caterpillars should come out of their winter quarters in midwinter is unexplained. The spiders which you send are immature specimens of some species of *Pardosa*. They can not be determined specifically on account of their immaturity.

Mytilaspis pomorum occurs upon a number of trees other than Apple, but so far as I know has not been recorded from Birch, although it is quite to be expected upon these trees, as it is found upon Linden, Maple, Willow, Poplar, Ash, Elm, and other trees.—[January 21, 1891.]

The Grape-vine Plume-moth.

I send some samples of our latest acquisition—shoots from our grapevines matted together by a small fuzzy or, rather, hairy, light-green larva about one-half an inch long. The twigs are all with distorted leaves, and of course no healthy bunches of grapes can be expected. Some of these twigs are covered with tiny white globules, clear as ice; scarcely a branch has escaped their ravages. Can I do anything to prevent their further increase? I have nipped off the affected parts and destroyed them, but of course many are left.—[Miss Amy J. Brown, Somers, Westchester County, New York, May 24, 1891.]

REPLY.— * * * Your grape tips are injured by the larvæ of the Grapevine Plume-moth (*Pterophorus periscelidactylus*). The insect is single-brooded and the damage will soon cease, but it will be quite important to pick off all of the infested tips from now on. Their number will not increase the present season. It is doubtful whether

spraying will have much effect unless you begin it earlier in the season, as the insects are so protected by the leaves.—[June 1, 1891.]

Parasite of Forest Tent-caterpillar.

I send you by mail some egg parasites bred from Forest Tent-caterpillar eggs this spring. The eggs of this species are surprisingly free from parasites. I only got six specimens of the species sent and no other parasites from about fifty egg clusters. I inclose you Professor Townsend's description of two *Tachinas* which appeared in *Psyche* recently. These were bred by me last fall. The smaller one was very abundant; over 80 per cent of the cocoons examined were infested.—[F. L. Harvey, Orono, Maine.]

REPLY.— * * * The small box arrived by the same mail and I was disappointed to find that one of the specimens had disappeared during the journey. The other, however, is a species of *Tetrastichus*, a genus in which we have an indefinite number of undescribed species in this country which are very difficult to separate.

Your species is probably undescribed. *Tetrastichus* is invariably, so far as we know, hyperparasitic and the primary parasite is in your case, probably, a *Telenomus* or a *Trichogramma*.—[June 2, 1891.]

An Anthomyiid injuring Sugar Beets.

I send to-day a few Sugar Beets planted in March and April. I find they have been attacked with some new enemy, and I fear a dangerous one. We have 1,000 acres, all very promising, but all are more or less afflicted with this disease.

I send you some imported seed, thinking the pest was imported with the seed. Three years ago all of the marsh mallow in the neighborhood of Watsonville was similarly afflicted. * * * —[W. V. Gaffey, Moro Cojo Ranch, Castroville, California, May 22, 1891.]

REPLY.— * * * Your beets have been attacked by the larva of some species of *Anthomyia* closely allied to the Cabbage Maggot and Onion Maggot. The exact species can not be ascertained without rearing the insect to the adult or "fly" state. This insect could not possibly have been imported with the seed, and it will be very interesting to know the nature of the crop previously planted on the same ground, or, if new ground, the nature of the vegetation before planting. None of the remedies which have been heretofore suggested can be applied with any satisfaction on such a large scale, and at this distance it is difficult to advise; and probably the best thing to be done will be to send you one of our California agents.—[June 1, 1891.]

Remedies against Sand-flies and Mosquitoes.

During two seasons of field work on the Geological Survey of Canada I have found pyrethrum powder an excellent thing to burn in the tent to stupefy and kill mosquitoes and black and sand flies. This powder is known by all druggists as "Insect Powder," or as "Pyrethrum Powder," and sometimes as "Dalmatian" or "Persian Insect Powder." It is a perfect "God-send" to tired men in the field after a hard day's work. Have also seen it used in the houses and stores of the Hudson Bay Company. When you retire to your tent at night, or for a nap at midday, close all the sides and the door of the tent, and burn about enough to cover a penny. Make the powder into a little pyramid or cone, on top of bark, stone, tin, or any other article, and light the tip with a match. It will smolder away, and the fumes will quite stupefy all the mosquitoes in the tent. It is useless out in the open, but I have found "Hind's Black Fly Cream" (prepared by A. S. Hind, pharmacist, Portland, Maine), an excellent preparation for repelling flies, etc. It should be applied every few hours when the flies are bad.—[A. M. Campbell, Box 126, Perth, Ontario, May 12, 1891.]

REPLY.— * * * The use of pyrethrum which you describe is by no means new, but your testimony as to its value is worth recording, and your recommendation of the "Black Fly Cream" is of value.—[May 15, 1891.]

The Horn Fly in Virginia.

I inclose two specimens of the "Horn Fly" that has been torturing our cattle for several years. This fly first attracted notice the summer of 1889 by appearing in swarms and settling around the horns of the cattle, seeming to do no damage beyond worrying them. The next year the cattle, especially the milch cows, commenced to show the result of the annoyance by falling off in flesh and in the flow of milk. They have never recovered from the attacks of 1890. This spring the fly has already appeared in numbers, and now they attack the cows in a new way, by causing numerous sores (under the belly principally). A Jersey cow just bought by us, and brought only 12 miles from here a fortnight ago, has been especially attacked. A half-dozen sores have already appeared on her body. She has fallen off in her flow of milk and in flesh. I have liberally annointed the cows with a preparation of tar, lard, and crude carbolic acid, but it does not drive the pest away; they settle wherever the hair is free from the ointment. Can you direct me what to do? Is there any way in which they can be kept from the cattle? What is the genus of the fly? * * * —[J. S. Strayer, box 31, Port Republic, Virginia, May 4, 1891.]

REPLY.—I am much obliged to you for this note concerning the occurrence of this insect in your neighborhood, and send you by accompanying mail a copy of a pamphlet which treats of its life-history and the best remedies so far tried. I shall be glad to have you try the remedies there mentioned and inform me of the result. I may take an occasion if events justify to send an assistant to Port Republic later in the season.—[May 5, 1891.]

A Plague of Grasshoppers in Idaho.

I understand there has been a commission constituted to examine and inquire into the grasshopper districts. This section has been a very great sufferer from this plague for five consecutive years. They seem to be native. They are of a small black variety and do not seem to migrate. Farmers are prevented from raising crops, cereals, and vegetables, and will soon be compelled to desert their farms and homes unless they get relief. If it is in the power of your Department to render aid, for the sake of humanity do so.—[Geo. B. Hill, Bellevue, Idaho, May 11, 1891.]

REPLY.—* * * There has been no commission recently constituted for the purpose which you mention, and the Entomological Commission, which was organized at the time of the Kansas and Colorado outbreak in 1874 to 1876, ceased to exist about 1881. The Entomologist of this Department, however, Prof. C. V. Riley, was chief of that commission and is much interested in the subject of damage by grasshoppers. Bulletin No. 25 of this Division goes over the whole subject of destructive "locusts or grasshoppers." Full information is given in this bulletin regarding the necessary remedies in such cases as yours. The Entomologist would be very glad to have you send on specimens of the particular species which is proving so injurious in your neighborhood. * * * —[May 16, 1891.]

Pacific Coast Termites.

I send a few live insects. I think you told me once they are *Termites*. The winged form was plentiful last January, but I only saw three when I took these. The soldiers are not plentiful. Where I chop the old wood there may be quantities of the smaller ones, and only an occasional soldier. Perhaps they hide farther away. The soldier must help some to provide food. I placed a few in a jar, and put in a fly. The soldier backed, and then with a run and a jump attacked the fly, and soon severed the head from the body, and left it to look for more. Other ants went immediately to sucking the headless trunk and the head.

How many forms are likely to be found in one colony? I have found very few small soldiers; only two or three even.—[Mrs. A. E. Bush, San José, California, May 24, 1891.]

REPLY.— The insect which you send is one of the common Pacific coast forms of the so-called “White Ants,” and is known as *Termopsis angusticollis*. Your note on the habits of the species is very interesting. I am not familiar with any detailed account of the habits of this genus, but there are likely to be four forms—male, female, ordinary worker, and soldier. If you have the opportunity, a careful study of its habits will be important, and I should be glad to receive from you specimens of all the forms—[May 4, 1891.]

GENERAL NOTES.

MASSACHUSETTS LAWS AND REGULATIONS AGAINST THE GYPSY MOTH.

AN ACT to provide against depredations by the insect known as *Ocneria dispar*, or Gypsy Moth.

Be it enacted by the Senate and House of Representatives in General Court assembled, and by the authority of the same, as follows :

SECTION 1. The State Board of Agriculture is hereby authorized, empowered, and directed to provide and carry into execution all possible and reasonable measures to prevent the spreading and to secure the extermination of the *Ocneria dispar*, or Gypsy Moth, in this Commonwealth; and to this end said State Board of Agriculture shall have full authority to provide itself with all necessary material and appliances and to employ such competent persons, servants, and agents as it, said State Board of Agriculture, shall from time to time deem needful in the execution of the purposes of this act; and said State Board of Agriculture shall also have the right itself or by any persons, servants, or agents employed by it, said board, under this act to enter upon the lands of any person.

SEC. 2. The owner of any land so entered upon, who shall suffer damage by such entry and acts done thereon by said State Board of Agriculture, or under its direction, may recover the same of the city or town in which the lands so claimed to have been damaged are situate, by action of contract; but any benefits received by such entry and the acts done on such lands in the execution of the purposes of this act, shall be determined by the court or jury before whom such action is heard, and the amount thereof shall be applied to the reduction of said damages, and the Commonwealth shall refund to said city or town one-half of the amount of the damages recovered.

SEC. 3. Said State Board of Agriculture shall have full authority to make from time to time such rules and regulations in furtherance of the purposes of this act as it shall deem needful; which rules and regulations shall be published in one or more newspapers published in the county of Suffolk; and copies of such rules and regulations shall be posted in at least three public places in each city or town in which said *Ocneria dispar*, or Gypsy Moth, shall be found by said State Board of Agriculture to exist, and a copy thereof shall be filed with the city clerk of each such city, and with the town clerk of each such town; and any person who shall knowingly violate any of the provisions thereof shall be punished for each such violation by a fine not exceeding twenty-five dollars.

SEC. 6. Any person who shall purposely resist or obstruct said State Board of Agriculture, or any persons, servants, or agents employed by it under this act, while engaged in the execution of the purposes of this act, shall be punished by a fine not exceeding twenty-five dollars for each offence.

SEC. 7. It shall be unlawful for any person knowingly to bring the insect known as *Ocneria dispar*, or Gypsy Moth, or its nests or eggs, within this Commonwealth; or for any person knowingly to transport said insect, or its nests or eggs, from any town or city to another town or city within this Commonwealth. Any person who shall offend against the provisions of this section of this act shall be punished by a fine not exceeding two hundred dollars or by imprisonment in the house of correction not exceeding sixty days, or by both said fine and imprisonment.

SEC. 8. The said State Board of Agriculture may exercise all the duties and powers herein conferred upon said board by and through its secretary and such members of said board as said board may designate and appoint to have in charge in conjunction with its secretary in the execution of the purposes of this act.

At a special meeting of the State Board of Agriculture held April 28, 1891, to consider an act of the Massachusetts legislature entitled "An act to provide against depredations by the insect known as the *Ocneria dispar*, or Gypsy Moth," and to provide for carrying out the provisions of said act, it was voted that William R. Sessions, N. S. Shaler, and Francis H. Appleton be a committee of the said board to exercise all the duties and powers conferred by the above-mentioned act upon the State Board of Agriculture.

WILLIAM R. SESSIONS,
Secretary.

RULES AND REGULATIONS.

1. All persons are forbidden by law to remove the Gypsy Moth, its nests, or eggs from one place to another, in any city or town, and are requested to exercise care against so transporting the Gypsy Moth on teams and carriages.

2. All persons are forbidden to remove from the present locality in the towns of Medford, Everett, Chelsea, Malden, Melrose, and Arlington any hay, manure, wood, bark, trees, rags, lumber, or shrubbery of any kind, without a written permit from the department. All loads must be well covered with canvas covers.

3. All persons are forbidden to, in any way, imitate or erase the marks employed by this department to designate trees, fences, or buildings which are infested or have been cleaned.

4. All vehicles leaving the above-named district may be stopped by the officers of the department, and delayed until their contents have been sufficiently inspected to determine the fact that they are not liable to transmit the eggs or any other form of the insect.

5. No person shall remove the bark from trees, nor attempt to scrape and clean them, without first notifying this department, and having said trees thoroughly inspected, and if found infested, cleaned under its direction.

The eggs of the Gypsy Moth are frequently scattered abroad by scraping the trees and by careless gathering; therefore, all persons except the authorized agents of this department are forbidden to remove the eggs of the Gypsy Moth from trees or other objects upon which they may have been deposited.

Real-estate owners and tenants are requested to destroy *all other forms* of the moth which they may find upon their premises.

6. All persons upon notice are required to confine their dogs while the agents of this department are at work upon their premises.

7. Owners and tenants are requested to gather and burn, before June 15, 1891, all rubbish and useless material upon their premises that may provide nesting places for the insect and to fill with cement or other solid material all holes in trees upon their premises.

8. All persons are requested to keep the windows of their houses protected by screens during the summer months, as it is found the insect often lays its eggs in the houses wherever it can gain admittance.

9. All persons having reasonable cause to believe that the eggs, caterpillars, or other forms of the Gypsy Moth exist on or about their premises are earnestly requested forthwith to notify E. H. Forbush, director, by letter addressed to his office in Malden, Mass. Information of their existence in isolated or unexpected localities will be gratefully received, and all persons furnishing such information will receive the thanks of the department.

10. Notice is hereby given that it will, in some cases, be necessary to remove boards from fences or buildings. In all cases they will eventually be replaced, if possible,

without damage to the structure. Attention is called to the fact that any damage done by the agents or servants of this department in the work of exterminating the moth may be recovered under provisions of section 2, as above printed.

Attention is also called to section 6 as above printed, which sets forth the penalties for obstructing any servant or agent of the State Board of Agriculture,

11. Courteous and considerate conduct is expected of all agents and employes of the department. Complaints in writing concerning any infraction of this rule should be sent to the director and will be heard by him or the committee.

WILLIAM R. SESSIONS,

N. S. SHALER,

F. H. APPLETON,

Committee of State Board of Agriculture.

THE EXTERMINATION OF THE GYPSY MOTH.

About the middle of June the entomologist made a short trip into the districts of Massachusetts most severely visited by the Gypsy Moth, with a view of observing the state of things and because it had been reported that the efforts being made to exterminate the pest were somewhat unsatisfactory. An investigation of the methods employed resulted in the conviction that they were not likely to be successful. The members of the committee having the matter in charge were unable to give much personal attention to the work, and the spraying was being performed in a crude and unsatisfactory manner, and without entomological supervision of an advisory character. No well directed and carefully conducted experiments had been made to ascertain what special methods are best for this specific case. As a consequence widely varying results had been obtained and in no instance, where trees were examined that had been treated, was it difficult to find living caterpillars yet upon them. The need of some one experienced in entomological matters to make proper biographic notes and to direct proper experimentation was apparent, and the fact was strongly urged upon Mr. Sessions, the chairman of the committee. It has recently been learned that arrangements have been made with Prof. C. H. Fernald whereby he will give active personal supervision to the work. This is a step in the right direction.

As the possibility of extermination becomes doubtful, all effort looking to the control of the species as one to be continually dealt with grows in importance, and it is strongly recommended that an effort be made to introduce some of the natural enemies of the species which are known to occur in Europe. The difficulties which the committee have to encounter are great. There is much prejudice against the use of Paris green, and individuals have interfered with the work more or less seriously, in some cases forcibly.

HOT WATER FOR THE ROSE CHAFER.

It seems from the experience of the present season that the Rose Chafer (*Macrodactylus subspinosus*) is peculiarly susceptible to the action of hot water. Mr. D. O. Kellogg, of Vineland, New Jersey, was the first to suggest this idea to us. He wrote us under date of June 8

that for the previous five days he had been experimenting, and had discovered that without doubt water heated even to a comparatively low temperature will kill the beetles. He had previously experimented with vegetable infusions, and was led to the discovery by the fact that his infusions were efficacious when warm, but useless when cold. He further wrote that he conducted his experiments before Colonel Pearson and Mr. John B. Smith, and that they would test the matter further. We immediately wrote to one of our Virginia correspondents, Mr. J. S. Strayer, of Port Republic, Virginia, asking him to test the remedy, and he reported perfect success.

On June 12 we again received a communication from Mr. Kellogg confirming his previous information, and desiring us to take the matter up by having a machine perfected for the application of steam. The use of hot water for this purpose was also independently discovered by Mr. E. S. Carman, of the *Rural New Yorker*. Under date of June 22nd Mr. Carman desired our opinion on an editorial note which was prepared for his paper, and which gave an account of the means by which he had arrived at the discovery. He noticed that during the hottest part of the day on June 15 the "Rose Bugs" sought shelter. He collected a number and placed them in a white paper box and exposed the box to the sun. In an hour or so the beetles were dead, when the temperature in the box was found to be 110°. Dropping them upon the soil when exposed to the direct rays of the sun had the same effect, and the beetles died apparently in 30 seconds. The temperature of the soil was found to be 129°. Other specimens were then placed in a box and a tablespoonful of water of a temperature of 129° was poured into the box and immediately poured out. The beetles were instantly killed. Other experiments were made with a spray pump, which resulted in the conclusion that a comparatively close spray of 125° temperature will invariably destroy the insect.

The evidence, both of Mr. Kellogg and of Mr. Carman, would seem to be so conclusive, that we were quite surprised, in some experiments of our own, to find that it was not very fully borne out. The season for the Rose Chafer in Washington had well-nigh passed, and we found comparatively few beetles to work upon. The experiments were conducted at our residence, at Sunbury, by Messrs. Marlatt and Chittenden, of the Division, and they showed that even at a temperature of 135° F. the beetles recovered slowly, after being actually immersed. Others sprinkled at close quarters with water at this temperature recovered, one flying away in two or three minutes afterwards. At 128°, when immersed for five seconds, all experimented with recovered, whereas two immersed one minute at a temperature of 125° were killed. This difference in results is difficult to account for, and the matter is of such great interest that we have sent Mr. A. B. Cordley to New Jersey with a view of experimenting on a still larger scale not only with hot water but also with steam, as it is evident that the use of hot water, where it is to be applied at any height, has many impractic-

cable features, as all fine spraying will rapidly cool the temperature, whereas if steam is generated, the required temperature can be more easily made to reach the insects. Incidentally also we wished to have further experiments made with the kerosene emulsion, with pyrethrum extract, and with kerosene extract of pyrethrum. The one great difficulty in the way of using effective destructive agents against the Rose Chafer, as we have pointed out in the columns of this Bulletin, and as we indicated to Mr. Carman upon the announcement of his discovery, is the continuous incoming of fresh beetles whenever they are excessively abundant, the result being that after destroying every beetle upon a given plant in the morning they may cover it again in the evening. A good and simple method of killing, however, will be of immense value, because of the fact that every female beetle destroyed will not only lessen the injury to some extent at the time, but will also tend to lessen it very materially for the ensuing year.

NEW HORTICULTURAL LAWS FROM CALIFORNIA.

The following is the full text of the amendment to the act to promote the horticultural interests of the State of California, passed during the last session of Congress, and defining the duties of the county boards of horticultural commissioners:

CHAPTER CLXXXVIII.—An act amendatory of an act entitled "An act to amend an act entitled 'An act to promote the horticultural interest of the State'" approved March 14, 1881, approved March 19, 1889.

(Approved March 31, 1891.)

SECTION 1. Section 2 of said act is hereby amended so as to read as follows:

SEC. 2. It shall be the duty of the county board of horticultural commissioners in each county, whenever it shall deem it necessary, to cause an inspection to be made of any orchards, or nursery, or trees, plants, vegetables, vines, or fruits, or any fruit-packing house, storeroom, salesroom, or any other place or articles in their jurisdiction, and if found infested with scale insects, or codlin moth, or other pests injurious to fruit, plants, vegetables, trees, or vines, or with their eggs or larvæ, they shall notify the owner or owners, or person or persons in charge or possession of the said places, or orchards, or nurseries, or trees, or plants, vegetables, vines, or fruit, or articles, as aforesaid, that the same are infested with said insects, or other pests, or any of them, or their eggs or larvæ, and they shall require such person or persons to eradicate or destroy the said insects or other pests, or their eggs or larvæ, within a certain time to be specified. Said notices may be served upon the person or persons, or either of them, owning, or having charge, or having possession of such infested place, or orchard, or nursery, or trees, plants, vegetables, vines, or fruit, or articles, as aforesaid, by any commissioner, or by any person deputed by the said commissioners for that purpose, or they may be served in the same manner as a summons in a civil action. Any and all such places, or orchards, or nurseries, or trees, plants, shrubs, vegetables, vines, fruit, or articles thus infested, are hereby adjudged and declared to be a public nuisance. And whenever any such nuisance shall exist at any place within their jurisdiction, or on the property of any non-resident, or on any property, the owner or owners of which cannot be found by the county board of horticultural commissioners, after diligent search, within the county, or on the property of any owner or owners upon which notice aforesaid has been

served, and who shall refuse or neglect to abate the same, within the time specified, it shall be the duty of the county board of horticultural commissioners to cause said nuisance to be at once abated, by eradicating or destroying said insects or other pests, or their eggs or larvæ. The expense thereof shall be a county charge, and the board of supervisors shall allow and pay the same out of the general fund of the county. Any and all sum or sums so placed shall be and become a lien on the property and premises from which said nuisance has been removed or abated, in pursuance of this act, and may be recovered by an action against such property and premises, which action to foreclose all such liens shall be in the proper court by the district attorney of the county, in the name and for the benefit of the county making such payment or payments, and when the property is sold, enough of the proceeds shall be paid into the county treasury of such county to satisfy the lien and costs; and the overplus, if any there be, shall be paid to the owner of the property, if he be known, and if not, into the court for his use when ascertained. The county board of horticultural commissioners is hereby vested with power to cause any and all such nuisances to be at once abated in a summary manner.

SEC. 2. This act shall take effect and be in force from and after its passage.

INSECTS STOPPING TRAINS—A TRUE STORY.

On page 30 of vol. I of INSECT LIFE, under the caption "Caterpillars stopping trains—a newspaper exaggeration," we gave an account of the supposed stopping of trains on a trestle over the Pedee River in South Carolina, in 1887, by myriads of Cotton Caterpillars, which proved upon investigation to be a gross exaggeration. The present spring, four years later, the *Evening Star* of Washington, under date of May 4, published a dispatch from Charlotte, North Carolina, stating that the rails on the Carolina Central Railroad were recently covered inches deep with caterpillars, and that for three days in succession trains were brought to a dead standstill, the driving wheels of the engines slipping round as though the rails had been thoroughly oiled. The engineers were obliged to exhaust the contents of their sand boxes before crossing the strip of swamp from which the caterpillars seemed to come. The rails and cross-ties were said to be obscured from sight, and the ground and swamps on each side of the track were covered with millions of the crushed caterpillars, and from the mass an unendurable stench arose.

On May 6 we sent one of our assistants, Mr. A. B. Cordley, to Charlotte, and upon his investigation the facts as stated were found to be substantially true. The locality where the caterpillars were most abundant was at the "Big Swamp," about eight miles east of Lumberton. The species proved to be the Tent Caterpillar of the forest (*Clisiocampa disstria* Huebn.). Mr. Cordley drove for eight miles through the forest from Lumberton to Big Swamp, and noticed that nearly all the oak and gum trees were completely defoliated. He was told by a gentleman who had recently traveled nearly all over Robeson County and an adjacent county, that wherever he had been the oaks and gums were badly defoliated. Mr. Cordley also interviewed the crew of one of the trains which was stopped, and ascertained that the newspaper account was perfectly correct. He found that the extraordinary abundance of

the caterpillars was probably due to the fact that the country immediately to the east of Lumberton is low and swampy, and in the past much of it has been over-flowed for a longer or shorter period during the winter and spring. Last summer, however, a canal was dredged through the swamp, in consequence of which the water the past winter and spring has been much lower than usual. It is quite probable that to this fact the extraordinary number of larvæ may be charged, the improved conditions due to drainage having encouraged the multiplication of the species.

This outbreak of *C. disstria* is of interest chiefly in that it enables us to add two more genera to the list of its food plants. In *Psyche* iv, p. 275, Mrs. A. K. Dimmock gives references which show the larvæ to feed upon plants of the following genera: *Quercus*, *Juglans*, *Fraxinus*, *Tilia*, *Rosa*, *Carya*, *Prunus*, *Acer*, *Cratægus*, and *Fagus*. To these we may now add *Liquidambar* and *Nyssa*, for the larvæ were found feeding freely upon both the Sweet Gum (*Liquidambar styraciflua*) and the Sour Gum (*Nyssa multiflora*). Indeed, the Sweet Gum seemed to be its favorite food plant, for almost invariably these trees were completely defoliated, while maples, hickories, and even oaks in the immediate vicinity were often scarcely injured at all. Next to the Sweet Gums, in the amount of injury received, were the various species of oaks, and then the Sour Gum.

We notice in the *Scientific American* of recent date that a similar occurrence was reported from Mankato, Minnesota, May 23. The larvæ were not determined, but the statement was made that they occurred on the railroad tracks in such enormous numbers that the engineers exhausted their sand boxes, and one freight train took an hour and ten minutes to go two miles.

Almost any insect when abnormally abundant will prevent proper traction of railroad wheels, and accounts of train stopping occur almost yearly. The insects most often involved are, the Army Worm, the Cotton Worm, the Tent Caterpillar of the forest, and various migratory locusts.

In another case, recorded in the *New York Herald* of May 31, the insect was not a caterpillar, but a large bug or beetle, either *Belostoma*, *Dytiscus*, or *Hydrophilus*. The locality was near Brighton Corners, New York (a place near Syracuse); and the story goes that as a freight train approached a deep dark cut over which an electric light was placed, the engineer noticed a dark moving mass extending for 60 feet along the track. With some hesitation he drove his train into the mass, which thereupon emitted a number of loud crackling noises like toy torpedoes. The wheels began to slip and the train was finally brought to a standstill. An examination showed the presence of swarms of insects which were described in the *Herald* as bearing a resemblance to the electric-light bug, a popular name now given to *Belostoma*.

The electric light over the cut accounts for the swarm, which was probably composed largely of water-beetles.

The present spring has been an unusual one with regard to the abundance of a number of species of insects, and some of the observations made are perhaps worthy of early record.

The White-winged Bibio (*Bibio albipennis*) has been present in phenomenal numbers and has attracted attention far and wide. I have had specimens from a number of localities, reports from others, and here at Ames it has been present in numbers never before observed.

One point with reference to its appearance in many localities is that so many report it as injurious to vegetation, and such statements as "eating corn, potatoes, * * * and everything," or "killing the fruit," and others equally strong, indicate a strong belief on the part of the observers that they have actually seen such injury. None have sent specimens of injured plants, and while there is perhaps a bare possibility that they could do some damage in blossoms, it seems more probable that they have excited attention by their immense numbers, and any injury found on the plants where they cluster has been ascribed to them. No damage to any of the plants they rest upon has been observed in this locality.

The Plum-leaf Plant louse (*Aphis prunifolii*) is another species that has been wonderfully abundant, so much so that for a time specimens were received almost every day from correspondents in widely separated localities. In some cases the injury reported was such as to have very serious effect upon the trees. The great amount of curling of the leaves renders thorough treatment with kerosene emulsion quite difficult for this species, and makes it specially important to begin treatment as soon as the lice first make their appearance.

The Currant Aphis (*Myzus ribis*) and the Cherry Aphis (*Myzus cerasi*) have also been unusually plentiful, as indeed are almost all the common species and a number that have never been observed here before.

Agallia sanguinolenta Prov. was very abundant in grass in early spring, and with the appearance of beets has attacked them.

Deltocephalus debilis is fairly swarming in blue grass, and I have found that for capturing these the most successful hopper-dozer yet tried is simply a long flat strip of sheet iron covered with coal tar and drawn flat on the ground.

Cutworms are very abundant, and reported destructive in many localities.—[Herbert Osborn, Ames, Iowa., June 2, 1891.]

PRECAUTIONS IN INVESTIGATING THE BITES OF POISONOUS ANIMALS.

Dr. R. W. Shufeldt has favored us with a copy of his paper entitled "Medical and Other Opinions upon the Poisonous Nature of the Bite of the Heloderma," and although this paper does not trench upon our province, the author's conclusions as to precautions will apply equally

well in the investigations of the bites of poisonous insects and spiders. He says, where the person has been bitten :

Ascertain, if possible, the exact condition of the patient at the time of the infliction of the wound, as regards both sobriety and his general condition, making sure that the reptile that inflicted the bite was a specimen of a *Heloderma*. Be careful not to destroy the victim with the remedies you administer to offset the effects of the bite. A quart of raw whisky, practically given at one dose, may prove more fatal than the bites of ten *Helodermas*. If the patient dies after the bite of one of the reptiles be sure to ascertain whether it was from the effects of the bite or from the effects of the remedies administered. The locality of the bite and other matters, of course, should also be carefully noted.

SOME TASMANIAN FRUIT PESTS.

In a note on some injurious and beneficial insects of Australia and Tasmania, published in *INSECT LIFE*, vol. I, p. 361, mention was made of the periodical appearance and depredations of the "Green Bug," *Diphucephala splendens* in orchards of both Australia and Tasmania. On the authority of Mr. Keene, of the latter colony, residing in the little hamlet of Kingston, the statement was made that this insect appeared regularly every four years, but, like our periodical Cicada, occurring during different years in different localities. In February, 1889, Mr. Keene told me that the year 1890 was the one during which they would next occur in his locality. Strictly in accordance with this statement, my friend and correspondent, Mr. Horace Watson, then residing at Kingston, but now living at Sandy Bay, near Hobart Town, writes me that the pest had put in its appearance in the neighborhood of Kingston and had seriously injured the apple orchards by destroying their foliage. In accordance with the data they will be due to appear in the Kangaroo Valley and about Hobart early in 1892, and, as my friend is now well provided with American appliances for spraying, we shall look for some interesting results from the effects of arsenical poisons.

Mr. Watson sends specimens of a "leach" which injures the foliage of Cherry, Pear, and Scarlet Hawthorn. Dr. Riley, who has kindly examined these larvæ for me, says they are not distinguishable from those of our Pear Slug, *Selandria cerasi*, and the leaves sent with them from Tasmania show an injury exactly similar to that caused by the Pear Slug.

Late in 1889 considerable apprehension was excited by the occurrence of a small grub in the fruit of the Cherry about Hobart, especially injuring varieties like the Florence and Bigaroon. Mr. Alexander Morton, F. L. S., after examination, expressed the opinion that the pest was the grub of our Plum Curculio, *Conotrachelus nenuphar*. What the final outcome of the matter proved to be I have never learned; but until our little Turk has reached the Pacific slope there is little reason for our Australian cousins to fear its appearance among them. Should the pest attack fruits other than cherries it might not be a bad idea for our California fruit-growers to be on the lookout for its importation, which appears the most likely of the two to occur.—[F. M. Webster, May 4, 1891.]

AFRICAN MICRO-LEPIDOPTERA.

Lord Walsingham read a paper at a recent meeting of the Entomological Society of London entitled "African Micro-lepidoptera." In this paper nine new genera were described, viz: *Autochthonus*, type *A. chalybiellus*, Wlsm.; *Scalidoma*, type *Tinea horridella*, Wkr.; *Barbaroscardia*, type *B. fasciata*, Wlsm.; *Odites*, type *O. natalensis*, Wlsm.; *Idiopteryx*, type *Cryptolechia obliquella*, Wlsm.; *Microthamna*, type *M. metallifera*, Wlsm.; *Liencocera*, type *L. lyonetiella*, Wlsm.; *Oxymachseris*, type *O. nireocercina*, Wlsm.; *Micropostega*, type *M. encofasciata*, Wlsm. Several European genera were recorded as new to the African fauna. The American genera *Phacasiophora*, Grote; *Æta*, Grote; *Polyhymno*, Chamb.; *Strobisia*, Clem.; *Anorthosia*, Clem.; *Ide*, Chamb.; and *Zarathra*, Wkr., were described as occurring in Africa. The genus *Philobota*, Megr., hitherto confined to the Australian region, was also recorded. The Indian genus *Timyra*, Wkr., was represented in Africa. *Nigilgia*, Wkr., was identified as a synonym of *Phycodes*, Gn. *Polyhymno*, Chamb., had been redescribed as *Copocercia* by Zeller. *Teratopsis*, Wlsm., was a synonym of *Cacochroa*, Hein.

Seventy-one species were described as new. The paper when published will be accompanied by colored figures of all the new species and structural drawings of the new genera and other genera which have hitherto not been figured.

The part of the paper which deals with *Cryptolechia*, Z., and its allies will especially interest American entomologists, for, as Lord Walsingham possesses the majority of the types of Zeller's genera he has been able to clear up the confusion that surrounded this group, owing to Zeller having changed his original types in his subsequent work.

EFFECTS OF TEMPERATURE ON THE COLORING OF LEPIDOPTERA.*

In part I of the Trans. Ent. Soc. London, Mr. Merrifield publishes the details of a series of temperature experiments in pedigree moth-breeding, begun in previous years, on the pupa of *Selenia illustraria* and *Ennomos autumnaria*.

By careful and long continued experiments he has demonstrated the possibility of producing artificially from a single brood of a moth, subject to seasonal dimorphism, four distinct "temperature" varieties, viz.: summer markings with summer coloring, summer markings with an approach to spring coloring, spring markings with summer coloring, and spring markings with spring coloring. The conclusions reached as a result of this series of experiments are, that the coloring and markings of the moth are affected by the temperature to which the pupa is exposed, the markings being chiefly affected by long continued exposure;

* Conspicuous effects on the markings and coloring of Lepidoptera caused by exposure of the pupæ to different temperature conditions. By Frederic Merrifield, F. E. S., Trans. Ent. Soc. London, 1891, part I (March), pp. 155-167.

that the coloring is affected chiefly during the stage before the coloring of the perfect insect begins to show; that a low temperature during this stage causes darkening, a high temperature producing the opposite effect, a difference between 80° and 57° being sufficient to produce the extreme variation in darkness caused by temperature; a further lowering of temperature having no further effect; that nearly the full effect in coloring may be produced by a range of temperature of from 76° or 80° to 65° in *autumnaria*, and from 73° to 60° in *illustraria*; that dryness or moisture during the entire pupal period has no appreciable effect on the coloring of the adult.

A general conclusion which the author ventures to suggest—provided we accept the theory of Professor Weismann that existing forms of North American and European Lepidoptera have come down from a glacial period—is, that “icing” the pupa causes the insect to revert to its earlier form, and that experiments of the nature here recorded might be of material assistance in tracing the evolution of the markings on the wings of the most highly developed forms.

In a supplementary note Mr. Merrifield adds that it is possible to cause either the summer or winter form to take on the coloring of the other, and produce from moths from the summer pupæ, specimens that resemble those from the winter pupæ, but not *vice versa*. The paper, including a table and supplementary notes, covers thirteen pages of text, and is illustrated by a plate of 16 life-like chromo-lithographic figures.

ANOTHER CARNIVOROUS BUTTERFLY.

The North American *Feniseca tarquinius* was the first Diurnal Lepidopteron known to be carnivorous in the larva state, its food being various species of *Pemphigus* (See Riley's remarks, *Am. Nat.* for June 1886). We now learn from Mr. de Niceville's great work on Butterflies of India, Burmah, and Ceylon, vol. III (as reviewed by Mr. S. H. Scudder, in *Can. Ent.*, vol. 22, No. 10, October, 1890), that the East Indian Lycænid genus *Spalgis* has also carnivorous habits, the larva preying upon a species of *Dactylopius*. Dr. Holland's suggestion (*Can. Ent.*, vol. 19, No. 4, April, 1887, p. 61) that the East Indian *Liphyra brassolis* might also have a carnivorous larva was based solely upon similarity in structure of the imago and has not yet been confirmed by actual observation.

SILK NEST OF A MEXICAN SOCIAL LARVA.

We have received through the kindness of Dr. Edward Palmer a delicate silk bag, perhaps 6 inches in diameter and 4 inches deep, which was sent to him in March, 1889, by Señor Liborio Vasquez, of Montezuma, Mexico, and concerning which his correspondent writes:

The Silkworm which makes the bag inclosed lives on the shrub called Madrono. It feeds on the wood of the tree and appropriates its fruit the entire year. I have seen it in the temperate (warm) climate of the Sierra Madre, where it occurs on a grand

scale. The accompanying sac is the seventh layer of one which the same little animal makes in order to winter and from which it issues in summer. I have witnessed with the greatest admiration the intelligence and activity of this insect. In one case I took them out of the sac and left them at the foot of the tree, and as soon as I left them they began to work, and in 24 hours they had stretched more than 5,000 fibers of silk thread as perfect as the silk of commerce.

The layer which we have received is very strong, although so thin as to be transparent. We can hardly surmise as to the larva which does this beautiful work, although it is undoubtedly Lepidopterous.

TENT CATERPILLARS IN EASTERN CONNECTICUT.

We learn from the *American Cultivator* of May 30 that the orchards in the eastern part of Connecticut have been seriously attacked the present season by vast hordes of the Tent Caterpillar of the orchard (*Clisiocampa americana*). They are said to have never been so numerous before. In many orchards the apple trees are enveloped in webs and have been killed outright. Almost every wild cherry tree has been killed. The farmers have adopted the plan of going through the orchards and firing blank cartridges into the webs, and it is said that a person traveling along the country lanes hears an almost constant fusilade of shots from small arms. The caterpillars have greatly reduced the prospects of the apple crop. The time will come when apple-growers will see the necessity of cutting down nearly all the neighboring wild cherry trees, which are practically useless, leaving only a few to act as traps upon which the moths will lay their eggs by preference, and upon which they can be carefully treated during the winter and early spring.

PARIS GREEN FOR CABBAGE WORMS.

The popular prejudice against the use of violent poison like Paris green upon a culinary vegetable like the cabbage may be allayed by Prof. C. P. Gillette's statement to the effect that where the green is dusted from a bag in the proportion of one ounce of the poison to 100 ounces of flour and just enough applied to each head to make a slight show of dust on the leaves, say for twenty-eight heads of cabbage one ounce of mixture, the worms will all be killed in the course of two or three days, while the average amount of poison on each head will be about one-seventh of a grain. Fully one-half of the powder will fall on the outside leaves and on the ground, and thus an individual will have to eat about twenty-eight heads of cabbage in order to consume a poisonous dose of arsenic even if the balance of the poison remained after cooking.

AN EXPERIMENT AGAINST WHITE GRUBS.

The bisulphide of carbon capsules, manufactured by Paul Jamain, of Dijon, France, have been recommended for use against Phylloxera abroad, and with a view of experimenting upon some of our subterranean insects we ordered a small quantity some time ago. One success-

ful experiment has been made for us by Mr. William R. Wood, florist and gardener, of this city. A small lawn, 20 by 30 feet, on Connecticut avenue, was badly infested by white grubs, probably the larvæ of *Al-lorhina nitida*, and Mr. Wood, on examination, found that they were present at the rate of 20 or 30 to the square foot, while the grass was nearly dead. Last September he sunk a number of the capsules of a capacity of 5 grams to a depth of 6 inches and at a distance of 3 feet apart, with the result that this spring the grass came up as green as ever and a careful examination showed no grubs at all. The exemption the present spring is without doubt due to the effects of the remedy, and not to the fact that the bugs when transformed to beetles had left the ground, for the reason that the soil last fall contained many half-grown larvæ. The capsules of this size cost 17 francs per thousand. They are made of a kind of gelatine, which dissolves by the action of moisture, liberating the bisulphide gradually. If they could be made cheap enough in this country they would prove good vehicles for the application of this insecticide to crops of special value, like the grape, and to valuable apple trees affected by the Root Louse, and also, as in the instance given above, to small lawns about city houses, although in such cases kerosene emulsion, applied in the manner described in vol. I, No. 2 of INSECT LIFE, will be equally efficacious and at the same time cheaper and easier.

MORE DAMAGE TO CORN BY THE BRASSY FLEA-BEETLE.

Mr. G. M. Dodge, of Louisiana, Missouri, contributes a note to *Coleman's Rural World* of May 28, 1891, stating that *Chaetocnema pulicaria* (mentioned as *Haltica punctulata*) has appeared in immense numbers upon young corn. The beetle eats away the pulp of the leaf, which then dries up. The fields of corn look as if touched by frost. Holes are even eaten through the leaf and frequently leaves are cut off.

PHYTOPHAGIC DUNG-BEETLES.

In a recent paper* Mr. Arthur E. Shipley refers to the ravages of *Lethrus cephalotes* to vineyards in southeastern Europe. This is a large black Scarabæid beetle, allied to the genus *Geotrypes*, and which has the pernicious habit of cutting off the young and succulent shoots of the vine, dragging them backwards towards their holes in the ground, in which the beetles live in pairs. The shoots are left to dry in the sun for a short time and are then carried into the holes, but whether they serve as food for the beetles or their larvæ has not yet been ascertained. The genus *Lethrus* belongs to the laparostict Scarabæidæ, also known as coprophagous Scarabæidæ, and is the only species of this subfamily known to injure cultivated plants. This subfamily is well represented

* On *Lethrus cephalotes*, *Rhynchites betuleti*, and *Chaetocnema basalis*, three species of destructive beetles (Proc. Cambridge Philos. Soc., v. 6, pt. VI, pp. 335-340.)

in North America; but while the food habits of a great many of our genera still remain unknown, there is nothing published to show that any species has habits similar to those of the European *Lethrus*. Our species, so far as known, are either dung-feeders or live in decaying fungi or in rich soil; a few of them (*Clæotus*) live under decaying bark, and most of our species of *Trox* breed on dried carcasses of animals. *Aphodius larrea* alone is reported by Dr. Horn as occurring in the flowers *Larrea mexicana*, and apparently feeds upon living vegetable matter, at least in the imago state. We would also call attention to the fact that one of our large species of this subfamily is probably phytophagous, as deep holes in the ground, evidently made by some large beetle of this group, have been found to contain, not the customary ball of dung, but an accumulation of leaves or pieces of leaves. The insect which has this habit is not yet known, but it seems possible that among our coprophagous Scarabæidæ we have one or several species which, in food-habit, approach the genus *Lethrus*, although they may not use leaves of any cultivated plant.—[E. A. Schwarz.

GERMINATION OF WEEVILED PEAS.

Prof. E. A. Popenoe, in the *Industrialist* (Manhattan, Kansas) for May 2, 1891, reviews the old question as to whether Peas, which have been damaged by Weevils, are fit for seed. He also gives an account of a series of careful experiments made at the Kansas Agricultural College, from which he concludes that weeviled seed should not be planted because it is worthless compared with sound, and because by planting infested seed without more care than is usually taken to destroy Weevils, one simply propagates the insect for the sake of a minimum return in plants. Out of 500 peas infested by Weevils but one-fourth germinated, and the partial destruction of the cotyledons rendered the further growth of these doubtful. A check lot of the same number of sound Peas gave a germination of 97 per cent. Of 1,800 weeviled Beans but 30 per cent could have passed the germinating stage, while 95 per cent of the check lot of perfect Beans germinated. The examination of 275 injured Peas showed but 69 in which the germ was not wholly or partially destroyed. This is a sad commentary on the statements of early authors who had much to say concerning the wonderful disposition of Providence in causing the Weevils to spare the germ of the seed.

THE DEVASTATING LOCUST IN CALIFORNIA.

For the first time since 1875 the Devastating Locust is reported in destructive numbers from California. We notice in the *Daily Appeal* (Marysville, California) of May 29 that Mr. G. W. Harney, president of the Yuba County Horticultural Commission, has made a tour of investigation and that the alarming rumors are not justified. He states that they were particularly numerous at Palermo, but did not create any

alarm, while some damage had been done to some young vineyards in the Brown's Valley irrigation district in Yuba County. The bran arsenic mash, which we recommended in our 1885 report, is being extensively used, and Mr. Harney reports that it works to perfection, but takes several hours to do its work. The Commission has printed a little slip, giving an account of this remedy, for general distribution. The commission also advises spraying trees about which it would not be safe to use the mash with a preparation consisting of one pound of buhach, three pounds of glucose, to ten gallons of water. The solution should be sprayed upon the trees late at night, and when the locusts fall to the ground stupefied by the buhach they should be gathered up and destroyed. In the case of very young vineyards plowing under so that the vines are covered with a thin coating of earth will save them, and in the course of a few weeks they will send up new shoots. Covering the young vines with paper-bags has been tried, but in many instances the locusts ate through the paper and reached the plants.

The *Pacific Rural Press* of May 30 contains a rather lengthy article upon the invasion of the present year. The insect is said to be present in considerable numbers through portions of the lower country of the Sierra Nevada foothills. Standing grain is being cut for hay to save it from the hoppers, and it is feared that as the fields are thus cleared the locusts will have gained their wings and will be able to fly to the vineyards and orchards of the adjacent regions of the foot-hills or to descend like a scourge to the valleys below. The methods of fighting the insect are given in brief, and an account of the bran-arsenic mash remedy just mentioned is published.

HOP LICE ON THE PACIFIC COAST.

Mr. F. L. Washburn, Entomologist of the Oregon Experiment Station, contributes an interesting summary of the work which he has done the present season upon these insects to the columns of the *NORTH PACIFIC RURAL SPIRIT* of May 21. He summarizes the now well-known life history of the insect, and states that it has been more abundant in Washington than in Oregon. Individual losses during 1890 ranged from \$100 to \$5,000. When the yards have been more or less shut in by timber or from other causes were so situated that but little sun and breeze entered, they were more badly affected than yards in more exposed situations. The eggs and the early generations of the lice were not found upon the Italian prune and very few were found on any variety of the cultivated plum or prune. Even the Damson is said to have been exempt, while Peterson's seedling or Peterson's Drupe has been found to harbor many eggs, and the Jefferson and the variety known as the Helen plum come in for quite a share. Professor Washburn recommends that the wild-plum thickets or seedlings be at once removed. He adopts our recommendation to burn the vines immediately after picking, and also recommends the use of caustic

sprays in winter, before the buds begin to swell, but makes no mention of the more practical course of spraying the plum trees with kerosene emulsion after the eggs have hatched.

MADE INSANE BY DESTROYING CATERPILLARS.

We see no reason to doubt the accuracy of the statement made in the following item which we clip from the *New York Sun* of June 7, 1891. We have frequently met with people who have exhibited such a strong idiosyncrasy against insects that similar results might follow were they forced to do the work which this boy was obliged to do.

BEAVER FALLS, PENNSYLVANIA, June 6.

Walter Sanders, 13 years old and son of a farmer living about 4 miles east of here, has become insane. On Tuesday he was sent into the orchard to destroy the caterpillars and their nests infesting the trees. He used paper, kerosene oil, and matches. The boy kept at the work for several hours, and the caterpillars would frequently fall upon him. In the course of the afternoon he was taken with violent nausea, and at night his parents were aroused by his moans. They found him tossing wildly, crying that the worms were eating him, and he begged them to take them off. A physician was hastily summoned, who, by a hypodermic injection succeeded in quieting the lad, but other similar attacks followed, and the doctor says he will have to be sent to an insane asylum.

NEW ENTOMOLOGICAL SOCIETY.

We notice from the *California Fruitgrower*, May 2, 1891, that a new society, entitled "The California Entomological Society," has been founded and that it expects to hold quarterly meetings at San Francisco. The first quarterly meeting was held April 24, at No. 220 Sutter street. E. M. Ehrhorn is the president and at the first meeting read a paper upon the San José scale, stating that *Aphelinus fuscipennis* Howard is the most abundant parasite of this destructive bark louse. He has also, however, reared *Coccophagus citrinus* Craw (a species which has as yet, we believe, never been described) and *Aphelinus mytilaspidis* Le Baron from the same scale. He also suspects that the first named parasite is to be reared from the Greedy scale (*Aspidiotus rapax*). This is quite likely, as *A. fuscipennis* is quite a general feeder and has been bred at the Department from *Aspidiotus perniciosus*, *Chionaspis euonymi*, *Mytilaspis gloverii*, and *Mytilaspis pomorum*.

MORE CONCERNING THE BITE OF THE KATIPO.

We are indebted to Mr. R. Allan Wight, of Pæroa, Auckland, New Zealand, for the following matter concerning an apparent case of death from the bite of the katipo. Seeing the item in the *Auckland Weekly News*, Mr. Wight wrote to Dr. Ewart, the medical attendant, and his reply is reprinted below the reprint of the newspaper item.

FEBRUARY 7.

An inquest was held to-day as to the cause of the death of Malcolm Fraser, an expressman, who, it was alleged, succumbed to the bite of a katipo spider. Dr. Ewart, medical superintendent at the hospital, who made a post-mortem examination, said in his own opinion death was due to the bite of the spider, the man being in a bad state of health at the time. The active cause of death was erysipelas, but that, in his opinion, was brought about by the bite.

In answer to a juror whether it was blood-poisoning and if the man's blood had not been out of order from the effects of drink, the witness said he did not think the poison of the bite would have been fatal.

The jury returned a verdict "That death was due to erysipelas, as a consequence of the bite of a katipo spider."

William Maskell, Registrar of the New Zealand University, said that he had some knowledge of katipo spiders. It belonged to a genus of which there were examples in many countries. There were similar spiders in America, Australia, southern Europe, northern Africa, and probably China, India, and Madagascar. In these countries there was a prevailing impression that this kind of spider was poisonous. Among scientific men who had studied spiders there had been doubt until recently whether spiders of this genus (*Latrodectus*) were really dangerous, but from a series of communications from various parts of the world which had lately appeared in an American publication called *INSECT LIFE*, published by the United States Government, it seemed as if it was fairly settled that the genus was venomous. It seemed probable that conditions of climate might have an effect, and that in hot climates or warm weather the poison might be more powerful. With regard to the New Zealand katipo spider, he had known of one previous case of poisoning and had heard of others. Mr. Maskell produced a list of cases prepared by Mr. R. Allan Wight, a resident of Auckland, the general effect of which was to show that the bite was not fatal to adult healthy persons, but in all cases there was very great pain, with severe depression and spasms. The witness next described the spider, and stated that it was found almost exclusively near the seashore, principally where there were sand hills. It was very common near the seashore in the vicinity of Wellington.

[Dr. Ewart's letter.]

WELLINGTON, February 19, 1891.

DEAR SIR: I answer your questions concerning the death of Malcom Fraser with the greatest pleasure.

He was admitted into the hospital on the morning of the 29th of January, and died on the 5th of February. At this time the right arm, from the hand up to the middle of the upper arm, was very much swollen and of a dusky-red hue, owing to erysipelas. At the point where he was said to have been bitten, there was a spot about the size of an ordinary flea bite on which the skin had a darker hue than the surrounding parts. He was perfectly sensible, but there was great depression of the vital powers. His wife informed me that he had been delirious during the previous night. Towards evening of the day of admission he again became delirious and never again recovered complete consciousness. From what the man himself told me and from the evidence given by his wife at the inquest, I think there is not the slightest doubt he was bitten by the spider in question. He seems to have been well acquainted with it, and stated most positively that he was bitten by the spider. He described it as a small spider, with a red gold-colored cross on its back. I can not say whether he was heated at the time or not. I imagine he was not, seeing that at the time he was bitten he was lying on the Hutt Racecourse. He had been attending the races, and the accident happened after the races were over. I can not tell you at what hour this happened, but it must have been late in the afternoon. He arrived here about 10 p. m., I think his wife said. He then told her he had been bitten by a katipo.

He went to bed but woke up his wife about 4 a. m., saying that his arm was very painful. She looked at his arm, and states that at this time there was a spot about the size of a shilling or a little larger, which was red and swollen. The redness and swelling continued to increase from that time until his admission. He was seen by Dr. McCarthy some days after this, who prescribed poultices and Turkish baths. At the time of admission, as I have already stated, he was in a very weak condition. His temperature was 103 and there was great depression of the vital powers. This, however, I ascribe to the erysipelas. His pulse was 120, very weak. His weakness rapidly increased, and the pulse became more frequent, and on the 2d of February diarrhoea set in. This continued until the time of death. The erysipelas also continued to spread, so that towards the end it extended beyond the shoulder on to the neck and back of the shoulder. On the 3d of February I made several incisions in the forearm and upper arm, giving escape to a quantity of acrid, watery pus. Before death a large part of the skin on the inner sides of the forearm and upper arm mortified. Several muscles in both these regions also mortified.

With regard to his state of health at the time of the accident, his wife states that he was quite well. The post-mortem examination, however, proved that he was not so, and I have good authority for saying that he was a chronic drunkard. The bite was on the back of the left forearm and close to its radial side, and about one inch above the wrist.

What the immediate symptoms were, I can not say. His wife states that at 10 p. m., on his coming home, he had some pain at the part, but there is no history of convulsions or tetanic spasms at this time. Dr. McCarthy states that at the time he first saw him there were spasmodic convulsions of the muscles of the arm, but for this I can not vouch.

He was bitten on the 21st of January. The post mortem showed mortification of a large part of the skin of the front of the forearm and on the inner aspect of the upper arm, also mortification of several muscles in both these regions. His liver was in an advanced state of disease (cirrhosis) due to long-continued intemperance. All the other organs were in a fairly healthy condition.

The treatment consisted of the ordinary remedies for erysipelas. The parts were also bathed with alkaline solutions. Poultices were applied, and stimulants (brandy) freely used. There seemed to have no beneficial effect upon the course of the disease.

As regards the nature of the poison I have no opinion to offer. It was a full week after the receipt of the injury before I saw him, so that I did not observe the primary symptoms.

I do not think that death would have ensued had not erysipelas set in. I do not, however, give a positive opinion upon this point, as I know nothing about the Katipo poison. I, however, feel quite sure that the bite was the starting point of the disease and that its effects were aggravated by the low state of health of the patient. You will thus see that my opinion is that death was *indirectly* caused by the spider bite.

I am yours, very truly,

J. EWART, M. D.

OBITUARY.

HENRY EDWARDS.—Henry Edwards, the well-known writer upon Lepidoptera, died June 9, 1891, at his home in New York City. He was born at Ross, Herefordshire, England, August 27, 1830. In his early manhood, which was spent in London as an actor, he began the study of entomology. Attracted, probably, by the entomological novelties to be collected in that then almost unknown country, in 1853 he went to Australia. In 1865 he removed to California, in 1878 to Boston, and in 1879 to New York. He was for some time president of the New York Entomological Club, and was one of the founders of *Papilio* and its first editor. In the summer of 1889 he went to Australia,

returning to this country last fall. Mr. Edwards wrote many descriptive and biological papers on the subject of Lepidoptera, but perhaps the most useful work which he has left behind him is his excellent catalogue of the described transformations of North American Lepidoptera. His collection, one of the finest in existence, is composed mainly of Lepidoptera, but contains extensive material in the other orders.

EDWARD BURGESS.—Edward Burgess, the well-known entomologist and yacht designer, died at Boston the early part of July, 1891. He was 43 years old at the time of his death. After graduating at Harvard in 1871 he was instructor in entomology for some time and became well known as a student of the Diptera. He published a number of descriptive papers and brought together a large collection. He also became interested in insect anatomy and published several admirable papers upon this subject. His anatomy of the Milkweed butterfly, published in the Memoirs of the Boston Society of Natural History, is a most admirable paper and a positive contribution to knowledge. Conjointly with Dr. C. S. Minot, he contributed the admirable chapter on the anatomy of *Aletia xyli* in the Fourth Report of the U. S. Entomological Commission. Some years ago he gave up entomology to devote his entire attention to the designing of yachts, in which he was preëminently successful. His collections and library became, by purchase, in part the property of the entomologist and in part that of this Department.

ENTOMOLOGICAL CLUB OF THE A. A. A. S.

The Entomological Club of the American Association for the Advancement of Science will meet in Washington August 19–26. The large number of eminent entomologists in Washington and vicinity assures an interesting meeting, and the extensive collections of the National Museum add a most important attraction, so that we may expect an unusually profitable and pleasant gathering of entomologists.

Let every one interested in entomology make it a point to be present. Those who expect to present papers in the club will please send titles to one of the officers.

HERBERT OSBORN, *President*.

CLARENCE M. WEED, *Secretary*.

ASSOCIATION OF ECONOMIC ENTOMOLOGISTS.

The fourth meeting of the Association of Economic Entomologists will be held in Washington on the 17th and 18th of August, 1891, in the rooms of the Department of Insects of the U. S. National Museum. The American Association for the Advancement of Science will meet on the 19th, and the Society for the Promotion of Agricultural Science is to meet on the 17th. The meetings of the Association of Economic Entomologists will be so arranged as not to conflict with the important meetings of the latter organization. The Association of Agricultural Colleges and Experiment Stations meets on the 12th, 13th, 14th, and 15th (the 16th being Sunday), so that the entire two weeks from August 12 to August 26 will be full of meetings of great interest to entomologists. A very full attendance is therefore certain, and this fact in itself will doubtless prove a great attraction to any who may be debating whether to come to Washington.

It is requested that members of this association wishing to read papers will send in titles as early as possible.

JAMES FLETCHER, *President*.

L. O. HOWARD, *Secretary*.

ENTOMOLOGICAL SOCIETY OF WASHINGTON.

THURSDAY, June 4, 1891.—William D. Richardson, of Fredericksburg, Virginia, was elected a corresponding member. Mr. L. O. Howard offered some remarks on the flight of Micro-hymenoptera, explaining the manner of flight of a minute species observed about his study lamp. He also exhibited a very minute Chalcid, an Entedonid from a collection made by Mr. H. H. Smith on the island of St. Vincent, which bore a label stating that the species had the power of emitting a marked odor which was perceptible at a distance of one foot. Discussed by Messrs. Marlatt, Riley, Schwarz, and Ashmead.

Dr. Fox exhibited a specimen of the young of *Epeira*, of which one palpus had male characters and the other the characters of the female. Discussed by Messrs. Marx and Riley.

Mr. Fernow made some additions to his previous observations on *Psilura monacha*. He said that the Government of Germany had recently appropriated \$350,000 to fight this moth, most of which will be spent on the lime treatment. He also called attention to a monograph on the May Beetles of Europe (*Melolonthas*), which he said contained a good many facts on the habits and means of treatment of these pests. He mentioned a fact given in this publication, viz., the migration of the larvæ, which he believed to be a new observation. The only method of treating these insects of any value is the collection of the last stages and of the adult. He also mentioned the influence of defoliation on the multiplication of the locust in connection with the recent invasion of these insects in the island of Cyprus, and similarly also on the multiplication of *Melolonthas*—such defoliation favoring the development of these insects. Discussed by Messrs. Riley, Howard, Schwarz, and Fernow.

Dr. Fox presented a paper entitled "A collection of Spiders from Indiana," in which he gave notes on the distribution of a number of the species recorded. He stated that quite a number of the species had not before been found in that part of the United States, but that he had not as yet had time to go over the material thoroughly. He proposed to prepare it for publication at some future date.

Professor Riley presented some miscellaneous notes as follows: He called attention to the injury done to roses in his yard and in the grounds of his neighbors by a small beetle, *Colaspis tristis*. He stated that he had first noticed the injury from this insect the present year, and that the roses had been very largely blighted by its attacks. The nature of the damage consisted in boring or eating into the buds and partly expanded flowers. He stated that this experience furnished another illustration of a common insect suddenly assuming a new injurious habit.

In connection with the remarks of Professor Fernow reported above, he gave a brief account of the work of the Commission in Massachusetts on the Gypsy Moth, *Oenertia dispar*. He stated that the Commission now has 150 men at work, and that Mr. Sessions, the Secretary of the State Board of Agriculture is very earnest and anxious to leave nothing undone that will help in the extermination of this threatening pest. Professor Riley also referred to the prejudice against the use of arsenicals, which has interfered somewhat with the work of the Commission, and which, at the request of Mr. Sessions, he had done his best to remove by a statement of the facts regarding these insecticides, showing that their use, with ordinary care, is free from dangerous consequences to live stock or man. He stated that he believed that most of the cases reported of

animals being poisoned by these arsenicals are hardly to be relied upon, and that in most instances the death had resulted from some other cause. He said in reference to the work of the Commission that however carefully it might be done, the extent of territory covered by the insect and the inherent difficulties of the task made him very doubtful of ultimate success in eradicating the pest. He gave some facts which he had gathered from conversation with Professor Shaler during his recent trip to Boston, regarding the manner in which this insect had been allowed to escape by Trouvelot. Professor Shaler had known Trouvelot very well, and said that he had left a batch of eggs on a window sill and allowed them to be blown away. He also referred to a spider, determined by Mr. Banks as probably *Pardosa albomaculata* Em., which had been found by Mr. William H. Edwards to seize butterflies on the wing. He referred again to the parasite obtained from *Eleodes suturalis*, the cocoons of which parasite he had exhibited and described at the previous meeting of the society. He mentioned that the imago had since been obtained and turned out to be a species of *Perilitus*, a fact of considerable interest because of the close relationship of this parasite with the one bred from *Megilla maculata* and described and figured in *INSECT LIFE*, vol. 1, as *Perilitus americanus*. Professor Riley also referred to the newspaper accounts of the demise of the well-known French entomologist, a personal friend of his, M. Kunckel D'Herculais, whose death is said to have resulted from an attack of grasshoppers, which, at the instance of the French Government, he was investigating in Algiers. These notes were discussed by various members.

Mr. Schwarz read a note on the Chrysomelid genera *Xanthonia* and *Trichotheca*, in which he pointed out that the femoral tooth of the latter genus appears to be only a sexual character, and that in *Xanthonia* the male has also a small but distinct tooth. Specimens of both genera were exhibited.

Mr. Schwarz also read a paper on "Verdigris in Insects," giving a list of those families or genera which are liable to verdigris in collections and adding some general conclusions derived from his experience with verdigrised specimens.

Discussed by Messrs. Riley, Howard, Schwarz, Pergande, Fernow, and Austin.

Mr. Stedman reported the results of certain investigations which he had been conducting on the character of the covering of the gills of aquatic larvæ of Diptera, stating that quite contrary to the formerly accepted idea, the gills are covered with a thin chitin, rather than a nonchitinous membrane. This fact he had established to his own satisfaction in the case of several species, and proposed to continue his observations and present a full report later.

C. L. MARLATT,
Recording Secretary.

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ABBREVIATIONS USED.—Abs., abstract; art., article; descr., description; indet., indeterminate; m. or men., mention; mm., mere mention; n.g. or gen. nov., new genus; n.sp., new species; ref., reference; rept., report; rev., review; sp., species of; syn., synonym.

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ERRATA.

- Page 32, line 5, for second "the" read that.
Page 34, line 26, for "natura" read natural.
Page 35, third article, line 4, for "*Papilioturnus*" read *Papilio turnus*.
Page 39, 5 lines from bottom, for "*Anthomyidæ*" read *Anthomyiidae*.
Page 37, 8 lines from bottom, for "yeavs" read years.
Page 44, heading of note, should read: "Bean insects in *Kansás*."
Page 54, 7 lines from bottom, for "*vittata*" read *12-punctata*. Five lines from bottom
tom, for "*Drastarius*" read *Drasterius*.
Page 58, under sub-family Calyptinæ, line 5, for "*amænum*" read *amœnus*.
Page 76, 8 lines from bottom, for "*Cheimatoba*" read *Cheimatobia*.
Page 83, line 13, for *L.* read *Platysamia*.
Page 87, 2 lines from bottom, for "*furcatus*" read *fuscatus*; for "*pubescus*" read *pube-*
scens.
Page 87, under "Entomological Society of Washington," 8th line, for "*Lathrodectus*,"
read *Latrodectus*; make same correction wherever it occurs (see index).
Page 91, 14 lines from bottom, for "*Æ. boris*" read *Æ. ovis*.
Page 92, line 5, for "*strobis*" read *strobi*.
Page 159, line 3, for "*a b d*" read *a* and *d*.
Page 165, 6 lines from top, for "*Melanectes*" read *Melanactes*.
Page 167, for "*Caliodes*" read *Caliodes*.
Page 221, line 3, for "attached" read attacked.
Page 246, line 10 from bottom, for "*rectangulus*" read *rectangularis*.
Page 249, line 8, for "pometeria" read *pometaria*. Line 15, for "*S.*" read *Saperda*.
Page 250, line 36, add H. Osborn, Ames, Iowa.
Page 254, 3 lines from bottom, for "*philadelphicus*" read *philadelphicum*; for "*cana-*
densis" read *canadense*.
Page 259, under note entitled "Insect diseases," for "*violan*," read *violans*.
Page 275, line 3 of foot-note, take out first "the."
Page 296, for "Cockerel" read Cockerell.
Page 297, second article, 6 lines from bottom, for "*Porthretia*," read *Porthetria*.
Page 300, two lines from bottom, for "corespondent," read correspondent.
Page 306, last line of first article, for "*Euplectruscom stockii*," read *Euplectrus com-*
stockii.
Page 307, title of third article, for "euculio," read *cureulio*.
Page 308, in second article, line 4, for "current," read *currant*.
Page 316, line 17, for "lilaceous," read *liliaceous*.
Page 321, line 2 of second article, for "specie," read *species*.
Page 323, lines 9, 11 and 22, for "*tesselata*," read *tessellaris*.
Page 324, line 20, for "*tesselata*," read *tessellaris*.
Page 324, line 41, for "*albosigna*," read *albosigma*.
Page 324, line 44, for "*angelica*," read *angelica*.
Page 324, line 50, last column, for 7, read 2.
Page 324, line 57, for "*bidentata*," read *bidentata*.
Page 324, line 66, for "*liquicolor*," read *lignicolor*.
Page 324, line 68, for "*subrotata* H," read *biundata* W.
Page 324, line 70, for "*biundata* W," read *guttivilla* W.
Page 324, line 72, for "*mantes*," read *manteo*.
Page 333, second article, line 9, for "*mauritanca*," read *mauritanica*.
Page 346, 7 lines from top, for "*Euphorbia*" read *Epilobium*. Error copied from Mr.
Saunders' work.
Page 349, line 1, for "is only," substitute has until recently been. After "attack,"
add only.
Pages 388, 389, where "*castanewella*" occurs, read *castanella*.
Page 394, line 23 from bottom, for "*nocturnus*" read *montanus*.

*LIST OF THE PERSONS ENGAGED IN GOVERNMENT ENTOMOLOGICAL
WORK.*

The following list embraces those now engaged in Government entomological work. The force of the Division of Entomology is more or less inconstant, as it consists of both permanent and temporary employés. Illustrations to this Bulletin, where not otherwise stated, are drawn by Miss Lillie Sullivan, under supervision.

DIVISION OF ENTOMOLOGY, U. S. DEPARTMENT OF AGRICULTURE.

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Office Staff: L. O. Howard, First Assistant; E. A. Schwarz, Th. Pergande, C. L. Marlatt, F. H. Chittenden, W. H. Ashmead, A. B. Cordley, F. W. Mally, Nathan Banks, Assistants.

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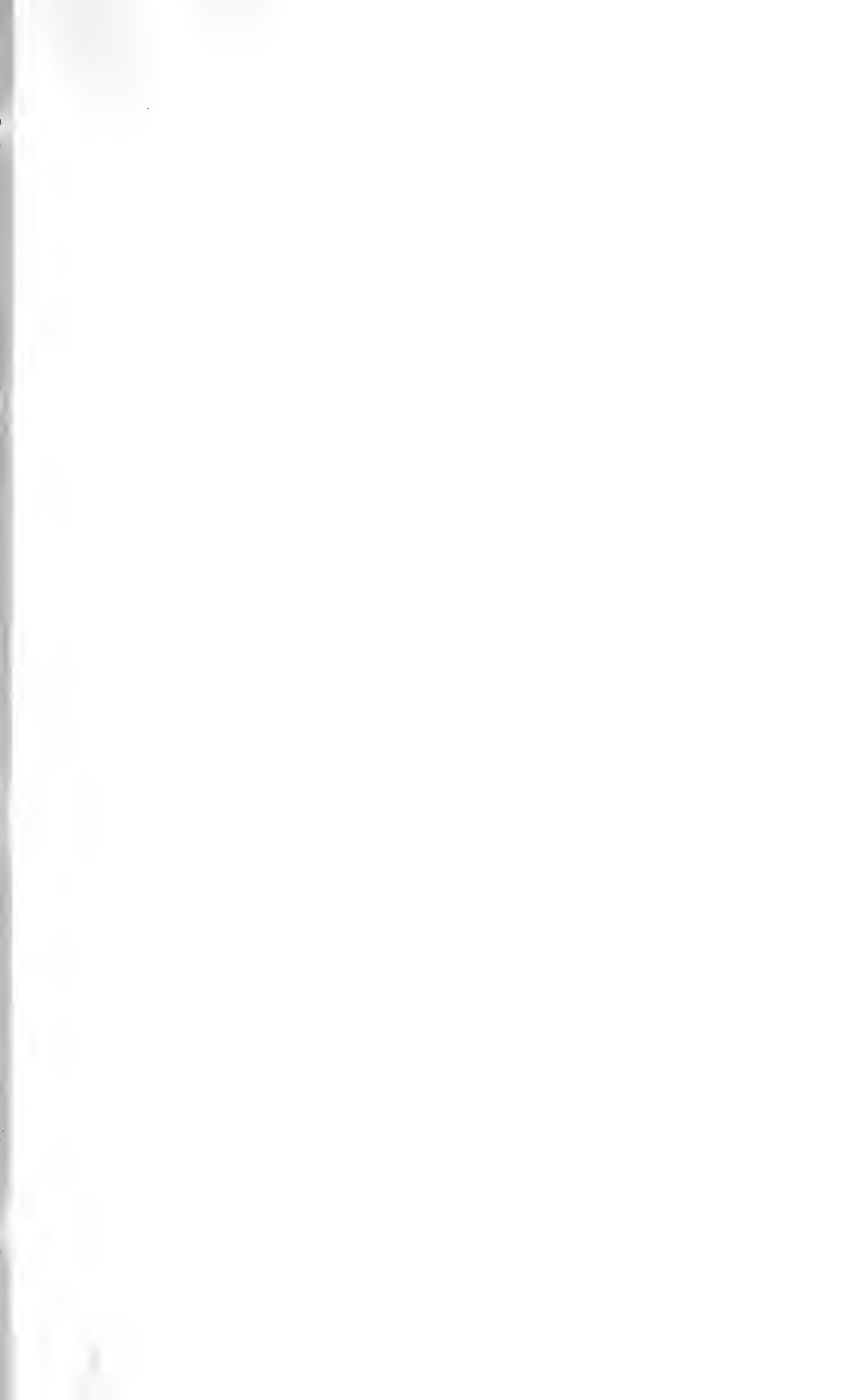
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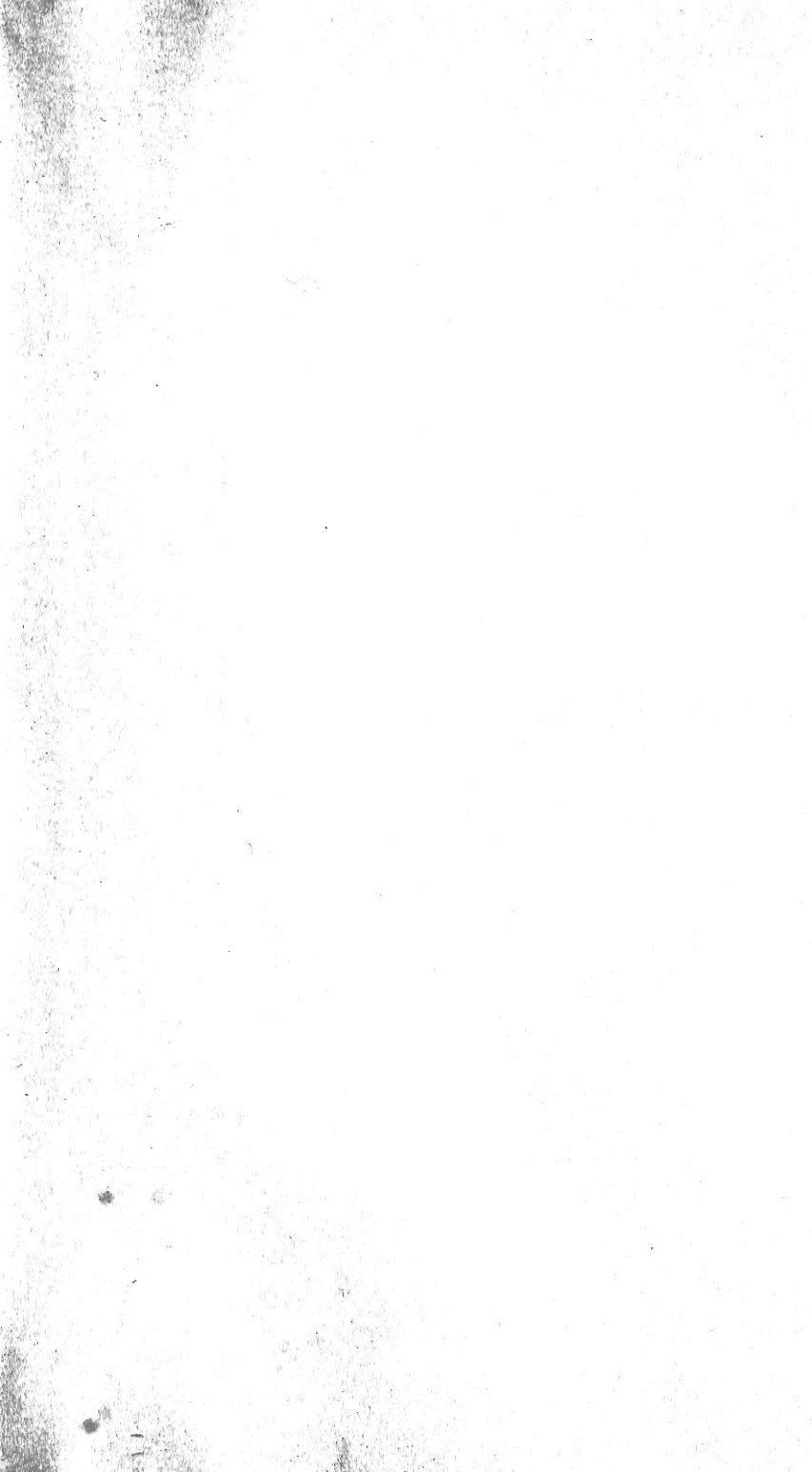
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